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WETLANDS IN THE PRAIRIE POTHOLE REGION OF MINNESOTA, NORTH DAKOTA, AND SOUTH DAKOTA--TRENDS AND ISSUES

by

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August 1982
Department of Agricultural Economics
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Fargo, North Dakota 58105

Submitted to

Office of Technology Assessment
Congress of the United States
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Executive Summary

The Prairie Pothole Region (PPR) covers about 227,000 square miles in North America, of which 60,000 square miles lie within Minnesota, North Dakota, and South Dakota. Prairie potholes perform various roles such as upland game habitat, flood water retention, ground water recharge, surface water quality improvement and recreation, however their major national importance is the provision of waterfowl nesting habitat. While the PPR comprises only 10 percent of the available duck nesting habitat in North America, it produces from one-half to two-thirds of the ducks raised on the continent. About 50 percent of the United States production of migratory waterfowl is raised in the United States' portion of the PPR.

Inventory and Drainage--Approximately 5.5 million acres of wetlands remain in the three state PPR out of an estimated original total of 19 to 22 million acres. Approximately half of the current remaining area is in North Dakota with 1.5 million and 1.3 million acres in Minnesota and South Dakota, respectively. Existing inventories are, however, extremely difficult to use for trend estimation. In North Dakota, nine inventories were identified covering the period from 1951 to 1982. The earliest actual inventory, 1951, yielded an acreage ranging from 2.4 to 3.0 million. Inventories completed in the sixties and seventies were in the 800,000 to 2.0 million acre range and the latest, 1982, inventory of wet soils was 2.7 million acres. It is expected that the National Wetlands Inventory, in progress, may yield estimates substantially higher than previous estimates. Reasons for this expectation include: 1) new technology in identification, 2) new definition of wetlands, and 3) substantially more time and money invested in the inventory. Annual pond counts made in May and July illustrate part of the problem of obtaining accurate inventories. May pond counts per square mile in North Dakota during the 1978 to 1982 period have been 9.26, 11.99, 3.18, 3.20, and 11.70 per year, respectively. The high degree of variability is primarily due to short-term climatic factors.

Various degrees of wetlands drainage have occurred in the PPR. About 80 percent of the PPR wetlands in Minnesota have been drained with recent studies indicating drainage rates in the PPR of 3 to 5 percent annually. In North Dakota, approximately 46 percent of the wetlands have been drained with recent drainage rates varying from less than 1 percent to greater than 2 percent annually. Drainage rates in South Dakota are estimated to range from less than 0.1 percent to slightly mmore than 1 percent annually. The total percent of wetlands drained is highly variable, as high as 95 percent drained in parts of eastern North Dakota, and 62 percent drained in southeastern South Dakota, to as low as 12 percent in Logan County, North Dakota.

It is difficult to summarize the past and present situation of wetlands (Table 1). There appears to have been 19 to 22 million acres of wetlands existing in the three-state area with approximately 5.5 million acres remaining. About 2.5 million acres are currently protected by various state and federal programs. Over 90 percent of the protected wetlands are in permanent easement or purchase programs. An estimated two million acres in North and South Dakota remain unprotected. In Minnesota, about 610,000 of five million acres (1955 inventory) of wetlands are protected.

Causes of Wetland Changes--There is general agreement that the primary cause of wetland drainage in the PPR is the economic-technological situation of agriculture. The specific components are:

1) Opportunity to gain relatively low cost productive cropland by draining wetlands.

TABLE 1. SUMMARY OF WETLANDS INVENTORY AND DRAINAGE IN THE PRAIRIE POTHOLE REGION

Year	Wetland Inventory	Drained Wetlands	Protected Wetlands	Unprotected Wetlands
	acres	acres	acres	acres
Minnesota				
Original	12-15 m			
		7-10 m		
1955	5,044,873			
	1,480,000[a]			
		947,000[b]		
1974	533,000[c]			
1982	d		610,435[e]	d
North Dakota				
Original	4,927,500			
1955	1,523,265	2,221,570[f]		
1982	2,705,930		1,366,293[g]	1,339,637
South Dakota				
Original	2,000,000			
1954	751,988[h]			
1964	1,381,475	85,268		
1982	1,296,207[i]		558,595[j]	737,612

[a] Includes only the Western Minnesota PPR, however not precisely defined.

[b] Western Minnesota drainage only, however a portion of the difference may be due to changed definition of PPR.

[c] Nineteen county Western Minnesota PPR.

[d] No statewide inventory is available since 1955, therefore remaining and unprotected wetlands are unknown.

[e] Includes an unknown overlap between 22,032 acres of USDA Water Bank and other programs. Also the estimate excludes 584,184 acres exempted from Minnesota property tax due to unknown overlap.

[f] Drained equals original minus 1982 estimate.

[g] Includes an unknown overlap between 69,943 acres of USDA Water Bank and other programs and estimates of state controlled wetland acreage of 37,855.

[h] Statewide inventory, but was incomplete.

[i] This estimate is based on the 1964 inventory minus documented drainage.

[j] Includes an unknown overlap between 30,765 acres of USDA Water Bank and other programs and an estimate of state wetlands.

2) Elimination of the nuisance and cost of avoiding potholes situated within cropland.

3) Change in farming from a diversified crop-livestock combination to increasing emphasis on row crop and small grain production.

4) Rapid increase in tractor horsepower which increases avoidance costs and facilitates drainage of potholes by providing the power to operate drainage equipment. This allows the landowner the opportunity to drain his own land during slack periods at low cash costs.

5) Continuing increase in center-pivot irrigation systems which are not compatible with potholes.

6) Variable short-term climatic conditions which increase nuisance and cost factors in a wet year and provide opportunity for low cost drainage in a dry year.

7) Short-term net farm income variability which provides investment capital for drainage during period of high income and increases the incentive to expand cropland area.

8) Absence of private returns from maintaining wetlands without government programs.

Governmental Programs and Regulations--Regulatory programs include Section 404, administered by the Corps of Engineers, and state drainage laws. Section 404 regulates fill activities but not drainage and wetlands of less than 10 acres that are within the nationwide permit. These two aspects remove nearly all private drainage activity from the Corps' jurisdiction. One study in Minnesota found only 8 percent of the wetlands in one county were within the Corps' jurisdiction.

Type 3, 4, and 5 wetlands over 10 acres in Minnesota are protected by state law. It was found in one study that only 12 percent of type 3, 4, and 5 wetlands were over 10 acres and nearly one-third of the wetlands meeting the legal description of Protected Waters had not been designated as such.

North Dakota requires a permit for drainage if the watershed is 80 acres or more. It is intended to resolve drainage conflicts among neighbors, not to preserve wetlands. South Dakota does not require permits for any type of drainage. Due to these jurisdictional limits, none of the drainage regulatory programs were deemed to be effective in preservation of prairie potholes.

Most prairie potholes, approximately 90 percent, fall outside of the jurisdiction of current federal and state regulations. In addition, problems of compliance and enforcement of regulations require local support which is lacking. Expansion of Section 404 authority to include drainage and repeal of the nationwide permit for wetlands of less than 10 acres would bring most potholes and threats to this resource under the Corps' administration. This would not eliminate the problem of local support; however, the ability to apply administrative penalty for violation of the law as well as permits may overcome some of the compliance problem. Proposed regulation changes move in the opposite direction however, by eliminating the size restrictions on isolated wetlands. This would effectively remove more potholes from regulation.

It did not appear that state regulatory programs would be strengthened in any of the three states on account of current political sentiments.

Preservation programs are conducted by the federal government and each of the three states. The U.S. Fish and Wildlife Service, and each of the appropriate state agencies have wetland purchase or easement programs. These were considered to be quite effective in wetland preservation with the limitation being funds to purchase or lease. North and South Dakota emphasize acquisition of uplands or woodlands, choosing to rely on federal acquisitions to preserve wetlands in their states. In addition, both federal and state acquisition programs in North Dakota have been stopped, pending formulation of a mitigation plan for the Garrison Diversion Project. Landowners would prefer short-term leases instead of perpetual easements and higher payments, but apparently these have not been major obstacles to preservation efforts.

The Federal Water Bank has been effective in terms of using all available funds for 10 year leases. Its present problem is that current funds are used primarily in renewing old contracts with very few new acres being added to the program.

Minnesota has two new programs, a water bank tied to its Protected Waters designation and a property tax exemption and credit for wetlands preservation. Both programs appear to have good potential for wetlands preservation. Their success, however, will be dependent on the continued financial support by state government.

Summary--Prairie potholes are an important national resource as a nesting habitat for waterfowl and of regional importance for upland game habitat, water storage, water quality enhancement, and ground water recharge. They are competitive with crop agriculture for space. This competition is intensified because returns of agriculture are received by the private landowner and the benefits of preserving wetlands are to the general public.

Current regulations have little effect on pothole preservation. Inclusion of drainage activity and removal of the 10 acre exclusion would bring most prairie wetlands under Section 404 authority. Compliance with this change would be primarily dependent on local support.

Preservation programs are quite effective, and the shorter-term leases have good local support. Problems occur with funding and that they are not a permanent means of preserving wetlands. As private economic incentives to drain increase, these programs can become very expensive.

I. PHYSICAL DESCRIPTION

The Prairie Pothole Region (PPR) of North America includes approximately 227,000 square miles of glacial till in Canada and the United States (Nord, undated). One-fourth of this area is in the United States (Figure 1).

Nineteen counties in the west central part of Minnesota contain about 15,000 square miles of the region. It is bounded on the west and north by glacial Lake Agassiz (Red River Valley), the hardwood belt on the east and the Minnesota River on the south. Approximately 41,000 square miles of the region are located in North and South Dakota. This area contains three distinct zones, 10,000 square miles in the Prairie Hills (Coteau des Prairie), 18,000 square miles in the Missouri Hills (Coteau), and 13,000 square miles in the Souris and Devils Lake basins.

Geology

The PPR was formed by the deposition of glacial materials during the last ice age. It left a variety of topographic forms ranging from the broad flat plain of the Red River Valley (formerly glacial Lake Agassiz) to fairly rugged Missouri Hills. Flat to rolling terrain is found in most of the Minnesota portion of the PPR. Steep morainic hills are common in Otter Tail, Becker, and Hubbard counties where elevation may vary 400 feet.

The drift plain (Coteau des Prairie) is the dominant geological formation in eastern South Dakota and extends northward between the James and Sheyenne Rivers to the Devils Lake Basin and beyond. Gently rolling ground moraine is the principal glacial land form of the drift plain.

The Missouri Coteau comprises the western portion of the PPR. It lies between the James and Missouri Rivers and is characterized by the knob-and-kettle topography of dead-ice moraine. Other glacial land forms such as land

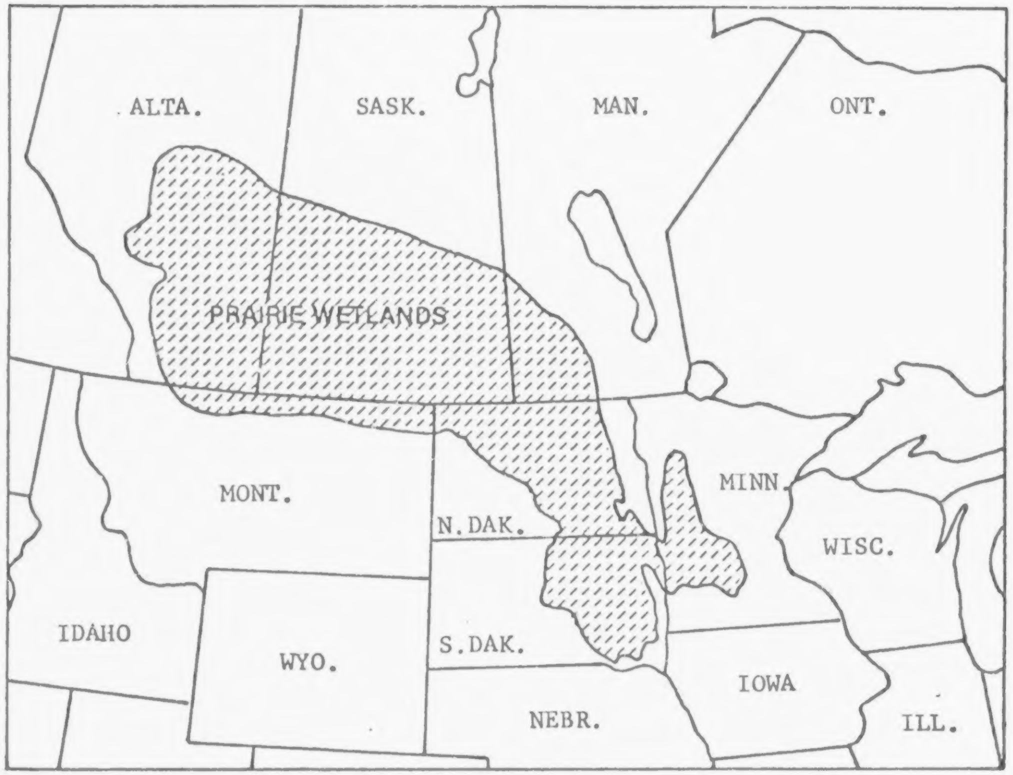
ALTA.
SASK.
MAN.
ONT.
PRAIRIE WETLANDS
MONT.
MINN.
N.DAK.
WISC.
IDAHO
S.DAK.
WYO.
IOWA
NEBR.
ILL.

Figure 1. Prairie Pothole Region

moraines, outwash plains, lake plains, and sand deltas, occur scattered throughout the area.

Climate

Temperature varies from 30° F. below zero to 100° F. above zero in all parts of the PPR. Mean July temperature ranges from 66° F. in the north to 75° F. in the southern portion. Annual precipitation varies from 14 inches in the northwest to 28 inches in the southeast. The majority of precipitation falls during the growing season of April through September.

Vegetation

The Minnesota portion of the PPR includes substantial forested area intermingled with crop and pasture. Forest and pasture disappear almost completely near the Red River Valley. The central portion of the PPR is primarily cropland with a small percentage of pasture. Permanent grasslands comprise one-fourth to one-half of the area in the Missouri Coteau with cropland remaining the major land use.

Wildlife

Migratory waterfowl is the category of wildlife in the PPR with the highest national importance. About 50 percent of the United State's production is raised in this area (Niering, 1972). It is also a very important migration route for Canadian geese, mallards, pintails, and other game ducks (Herbison, 1967).

Wetlands are important habitat for other types of wildlife. Furbearer harvest generated $3.8 million in North Dakota during 1978. These included muskrats, mink, beaver, raccoon, red fox, badger, bobcat, coyote, jack rabbit, skunk, and weasel. The uplands surrounding prairie potholes provide habitat for many species such as whitetail deer, sharptail grouse, ringneck pheasant, and hundreds of species of nongame mammals and birds.

Economics and Demographics

Agriculture, including farming and supporting activities is the number one economic activity. Production of small grains (wheat, durum, and barley), row crops of corn and sunflower, and beef production are the major agricultural enterprises.

Population density is low with no urban places greater than 30,000 and only six cities greater than 5,000 population in the PPR. The typical community has a population between 500 and 1,500 people with a business sector heavily dependent on serving agriculture. Tourism is important in the eastern portion of the Minnesota PPR and for a short time during goose and duck hunting in North and South Dakota.

Government Units

The PPR includes three states, Minnesota, North and South Dakota, which are quite dissimilar with respect to their roles in wetland regulation. Minnesota has been active in protection programs and has fairly restrictive drainage policies. North Dakota has a drainage permit law, but has not been active in wetland protection. South Dakota state government is not involved in wetland drainage unless disagreements cannot be solved at a local level.

County and township government along with special districts such as drainage and water resource boards can be quite important at the local level. Land use zoning, permitting, and enforcement of regulations are usually controlled by these local units.

II. WETLANDS--DESCRIPTION AND TRENDS

"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water" (Cowardin _et al_., 1979). "They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river-overflow lands" (Shaw and Fredine, 1956).

The first generally used classification system for wetlands was published in 1956 (Shaw and Fredine) by the United States Fish and Wildlife Service (USFWS). It was replaced by another, more complex system in 1979 (Cowardin _et al_., 1979). The earlier system continues to be used by many individuals and agencies due to its relative simplicity, codification in many regulations and laws, and inertia.

Five of the 20 classes designated by Shaw and Fredine are significant in the PPR. These are:

Type 1. Seasonally flooded basins or flats--soil is covered by water or is waterlogged during seasonal periods but is well drained during much of the growing season. It is important during the waterfowl nesting season.

Type 2. Inland fresh meadows--soil usually is covered by water only during seasonal periods, but is waterlogged within a few inches of its surface during the growing season. Their value to waterfowl is nesting and supplementary feeding area.

Type 3. Inland shallow fresh marshes--soil is usually waterlogged during the growing season and often covered by six inches or more of water. They contain marsh vegetation and are used extensively as nesting and feeding habitat in the PPR.

Type 4. Inland deep fresh marshes--soil is covered with six inches to three feet or more of water during the growing season. They contain large areas of marsh vegetation and constitute the best breeding habitat for waterfowl.

Type 5. Inland open fresh water--shallow ponds and reservoirs are included in this type. Water is usually less than 10 feet deep and is fringed by emergent vegetation. They are used by waterfowl as brood areas in the PPR during mid and late summer.

North and South Dakota also contain small numbers of the following wetland types:

Type 9. Inland saline flats
Type 10. Inland saline marshes
Type 11. Inland open saline water

Minnesota contains large areas of the following types; however they are not within the prairie pothole region:

Type 6. Shrub swamps
Type 7. Wooded swamps
Type 8. Bogs

The system currently in use by USFWS and used in the on-going National Wetlands Inventory is more complex. It is based on a three level hierarchical structure with several additional modifiers (Cowardin, 1979). No completed inventories using this system are available, therefore it will not be described in this report.

Inventories and Drainage

Minnesota

The first available data on wetlands were based on the Swamp Land Acts of 1849, 1850, and 1860. The state of Minnesota was granted 4,706,503 acres for swamp reclamation in 1860 (Shaw and Fredine, 1956).

A 1950 water area inventory identified 639,549 acres of wetlands in the prairie pothole area of 15,803 square miles.[1] Sixteen percent, 123,737 acres, had been drained during the 1945 to 1950 period. Potholes were being lost at a rate of three percent annually in 1950 (Nord, et al.).

The only complete inventory was done by USFWS in 1955 (Mann, 1957). Types 6, 7, and 8 are outside of the PPR, leaving an upper limit of 2.6 million acres of Types 1 to 5 (Table 1). The 1955 inventory did not tabulate acreages by type for each county. A rough estimate is that 1,480,000 acres of Types 1 through 5 were located in western Minnesota (USFWS, 7/1979).[2]

TABLE 1. INVENTORY OF MINNESOTA WETLANDS, 1955

Type	Acreage
1	274,927
2	1,223,828
3	482,459
4	275,436
5	421,561
6	1,146,769
7	1,050,550
8	169,343
Total	5,044,873

SOURCE: Mann, 1957

A FWS 1964 inventory indicated over 323,000 acres of Types 3, 4, and 5 wetlands in 19 western Minnesota counties (USFWS, 1974). This inventory excluded other wetland types and was, according to FWS, an underestimate of Types 3, 4, and 5. In 1974, FWS inventoried over 533,000 acres of wetlands in these 19 Minnesota counties (FWS, 1974).

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[1] The precise definition used to inventory wetlands was not presented by Nord.

[2] This estimate was based on maps in FWS Circular 39 (Shaw and Fredine, 1956) and did not follow county boundaries.

The Minnesota Department of Natural Resources has released preliminary data for 14 western Minnesota counties (Table 2). Only 82,600 acres of wetland Types 3, 4, and 5 greater than 10 acres were identified. They project only 250,000 acres of types 3, 4, and 5 currently exist out of a 1953 statewide total of 1.2 million acres, a decrease of 79 percent.[3] The department is projecting that only 2.25 million acres of an original 12 to 15 million acres of lakes and marshes exist in 1982 (MN DNR, 6/1/82).

TABLE 2. WETLANDS INVENTORY FOR SELECTED MINNESOTA COUNTIES AS OF JUNE 1, 1982

County	Type 3		Type 4		Type 5		Total	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Clay	81	1,867.5	67	1,050.5	51	1,262.2	199	4,180.2
Mahnomen	128	3,248.4	166	3,634.6	20	818.4	314	7,701.4
Becker	268	7,387.7	247	6,106.7	120	4,528.6	635	18,023.0
Chippewa	14	289	13	309	0	---	27	598
Big Stone	2	26	195	5,060	24	642	221	5,728
Stevens	34	897	57	1,234	7	218	98	2,349
Traverse	13	548	20	515	0	---	33	1,063
Grant	54	1,110	56	1,615	32	713	142	3,438
Otter Tail	183	4,626	213	4,502	309	6,521	705	15,649
Wilkon	4	91	1	12	2	45	7	148
Pope	93	3,680	124	3,190	49	1,592	266	8,462
Douglas	65	1,601	117	3,145	65	1,739	247	6,485
Swift	66	1,489	54	1,495	3	55	123	3,039
Kandiyohi	66	2,251	120	2,878	24	615	210	5,745

SOURCE: Minnesota Department of Natural Resources. 1982. "Protected Waters and Wetlands Inventory Status Report, June 1, 1982." Division of Waters, St. Paul, Minnesota.

Berry (1981) estimated that there were 2,564 wetlands in Douglas County, Minnesota, which totaled 17,005 acres. Most of these wetlands, 2,138 with 6,473 acres, were less than 10 acres. Nearly 80 percent of the wetland numbers was privately owned and 84 percent of the areas was undrained.

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[3] Size of wetlands was not specified in the projection.

A 1968 inventory by the Minnesota Conservation Department found 15,291 waterbasins including 3,257 dry basins greater than 10 acres (Legislative Auditor, 1978). Most of 3,257 dry basins had been artificially drained, although a few were dry due to climatic factors. Basins less than 10 acres have not been inventoried, however, a consensus estimate is that between 15,000 and 20,000 basins less than 10 acres are concentrated in the prairie pothole country and in the peat area of the northwest (Legislative Auditor, 1978). There are about 7,000 undrained basins between 10 and 100 acres, about 2,500 are feasible to drain.

Highway construction alone was estimated to have drained 29 percent, 99,292 acres, of the 342,386 acres which existed in a 19-county western Minnesota area in 1964 (Madsen, 1975).

The major inventories of Minnesota wetlands are summarized in Table 3. By the 1950s, approximately half of the state's wetlands were drained. The drained wetlands were primarily outside of the present PPR, concentrated in Southern Minnesota and in the Red River Valley. U.S. Fish and Wildlife Service estimated as high as 1,480,000 acres of Type 1 to 8 may have existed in Western Minnesota based on the 1955 Mann inventory. The 1974 USFWS inventory of 19 western Minnesota counties is considered to be the most accurate of completed recent inventories. Only Types 1 to 5 are included in the 533,000 acres. Trends are not possible to quantify to the changed definitions between inventories.

Two recent studies by the Minnesota Department of Energy, Planning, and Development (MDEPD) point out the difficulty of comparing information from different inventories. The summary of inventories and other information sources in Table 4 illustrates the problem (MDEPD, 3/1982). The existing inventories and other sources are inconsistent, partial, and use different

TABLE 3. COMPARISON OF WETLAND INVENTORIES FOR MINNESOTA

Year	Source	Wetland Acreage
1. Original	DNR	12-15 million[a]
2. 1860	Shaw and Fredine	4,706,503[b]
3. 1950	Nord	639,549[c]
4. 1955	Mann	5,044,873[d]
5. 1955	USFWS	1,480,000[e]
6. 1964	USFWS	323,000[f]
7. 1974	USFWS	533,000[g]
8. 1982	DNR	82,600[h]
9. 1982	DNR	250,000[i]

[a] All water bodies.
[b] Swampland.
[c] Within 15,803 square miles of PPR.
[d] Statewide.
[e] Types 1-8 in western Minnesota.
[f] Types 3, 4, and 5 in 19 western Minnesota counties.
[g] Types 1, 2, 3, 4, and 5 in 19 western Minnesota counties.
[h] Types 3, 4, and 5 over 10 acres in 14 western Minnesota counties.
[i] Types 3, 4, and 5 over 10 acres, statewide.

SOURCES: 1) Minn DNR, 6/1/82; 2) Shaw and Fredine, 1956; 3) Nord, undated; 4) Mann, 1957; 5) USFWS, 7/79; 6&7) USFWS, 1974; and 8&9) Minn DNR, 6/1/82.

definitions and classification systems. Continuation of this nonuniform method of data collection will frustrate future attempts to establish trends.

The second Minnesota study compares several data sources for Dovre township in Kandiyohi County (MDEPD, 6/1982). Substantial differences were found, due to a variety of factors (Table 5). These differences, over 100 percent, were identified and adjustments made only after a time consuming process of comparison. County assessor records of privately owned wetlands were also checked and compared to the 1980 National Wetland Inventory. Assessor records showed 1,236 acres, compared to 6,466 qualified acres in the NWI.[4] When the NWI was adjusted for: 1) types 1 and 2, 2) government owned

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[4] Types 1 and 2 wetlands were excluded from the NWI.

TABLE 4. SUMMARY OF WETLAND INVENTORIES IN MINNESOTA

DATA SOURCE	PAGE	METHODOLOGY							STORAGE FORMAT				METHOD OF CLASSIFICATION				WETLAND TYPES INCLUDED (in terms of Circular 39 definitions)				RESOLUTION OF ACCURATE COVERAGE			UPDATED				AREAS OF MINNESOTA COVERED				COMMENTS
(F) - Federal Program (S) - State Program (R) - Regional Program (C) - County Program		Landsat	Aerial Photography	Sampling	Windshield Survey	Permit Application	Payment/Purchase Agreements	Interviews/Other	Mapped	Digitized	Tabulated	Computerized	Circular 39	USF&WS - Cowardin Method	Other	None (wetlands not classified)	Type 1	Type 2	Types 3-5	Types 6-8	Less Than One Acre	One to Ten Acres	Greater Than Ten Acres	Not Anticipated	As Needed	At Least Annually	3-5 Years	N.E.-N. Central	Southern	West-Central	Red River Valley	
INVENTORY PROGRAMS																																
(F) National Wetlands Inventory	10		●						●					●			●	●	●	●	●	●	●		●			●	●	●	●	Funding questionable. The most detailed and comprehensive of all inventories. Expensive. Updating difficult.
(F) Western Minnesota Wetlands Inventory (1974/1976)	15		●						●		●		●						●	●	●	●	●	●					○	●	○	Has been incorporated into the NWI.
(S) Protected Waters and Wetlands Inventory	24		●					●	●		●		●						●					●				●	●	●	●	Since protected wetlands will not be drained, this program does not monitor trends.
(R) Metropolitan Wetlands Inventory	38		●						●		●				●			●	●	●		●	●				●					Limited in scope: includes the 7 county Metro Area only.
ACQUISITION/PROTECTION PROGRAMS																																
(F) USF&WS Wetland Easement and Acquisition Program	18						●		●		●			●			●	●	●	●	●	●	●			●			○	●	○	Comprehensive only for wetlands acquired under this program.
(F) Federal Waterbank Program	21						●		●		●					●			●	●	●	●	●			●			○	●	○	Voluntary participation of wetland owners yields incomplete wetlands data.
(S) DNR Wetlands Acquisition Program	31		●				●		●		●	●			●		●	●	●	●	●	●	●		●			●	●	●	●	Tracks only acquired wetlands which are not likely to experience much change.
(S) State Waterbank Program	29						●		●		●		●						●				●			●		○	●	●	●	The eligibility requirements greatly limit the comprehensiveness of this data.
REGULATORY PROGRAMS																																
(F) U.S. Army Corps of Engineers Permitting Program	19					●										●	●	●	●	●			●			●		●	●	●	●	Wetlands data is difficult to distinguish from other water bodies data. Enforcement spotty.
(S) DNR Master Permit Index System	27					●								●					●				●		●			●	●	●	●	Unprotected wetlands (≈ three-quarters of all wetlands) are not tracked.
OTHER PROGRAMS																																
(F) Trend Analysis of National Wetland Gains and Losses	13		●	●					●	●	●	●		●			●	●	●	●	●	●	●		●			●	●	●	●	Statistically accurate on a nationwide basis only. Needs expansion to yield state/county data.
(C) County Assessor's Records: Wetlands Tax Credit Program	33		●		●			●			●	○				●			●		●	●	●			●			○	●	●	Acreage figures based on owner's voluntary application. Not comprehensive.
(C) County Assessor's Records: Reimbursement Program for Wetlands Tax Exemptions	36		●		●			●			●	○				●			●		●	●	●			●			○	●	●	Hopeful source if definitions and methodology are standardized. 20 counties are not covered.

○ Only in some counties (Storage Format)

○ Not all counties included (Areas of Minnesota Covered)

SOURCE: MDEPD, March 1982.

TABLE 5. COMPARISON OF THE 1974 FWS WESTERN MINNESOTA AND 1980 NATIONAL WETLANDS INVENTORIES

	1974 WMWI	1980 NWI
Total Wetlands	3,084.7 acres	6,613.23 acres
Wetlands after adjustments*	2,962.7 acres	3,443.68 acres

*Adjustments included: 1) The 1974 Water Minnesota Wetlands Inventory (WMWI) did count Types 1, 2, 6, and 7, lakes classified as fish lakes, and wetlands on the periphery of fish lakes; 2) WMWI was flown in a dryer year; and 3) map edge coordinates differed and wetlands which straddled to township boundary were counted in the WMWI.

SOURCE: MDEPD, 6/1982.

wetlands, 3) Lacustrine DNR Protected Waters, and 4) wetlands associated with Lacustrine DNR protected waters, the NWI was 1,340 acres, or 108 percent of the assessor's records.

A third phase of this study checked to determine the proportion of wetlands which were protected. Programs included were the Minnesota DNR Protected Waters Program, USFWS Waterfowl Production program--lease and purchase, and the DNR Wildlife Lands Acquisition Program, all of which are permanent. These wetlands preservation programs protected 83 percent of the acreage, but only 33 percent of the numbers of wetlands (Table 6). Only 27 percent of the wetland acres are protected after 14 deepwater lakes were eliminated from the count. Only 12 percent, 52 of 425, of the Type 3, 4, and 5 wetlands were 10 acres or larger and therefore protected by Minnesota law. Seventeen of the 52 wetlands over 10 acres had not received a DNR protected waters designation either due to error or protest by landowners. Types 1, 2, 6, and 7 are virtually unprotected as are many other wetland types less than 10 acres.

National Wetlands Inventory Classification	Circular 39 Equivalency	Total Acreage	Total Wetlands Basins	Total Feet of Shoreline	DNR Protected Water or Govt. Owned Wetlands-- ● DNR Protected, ●● Govt. Owned, ●●● Both DNR Protected & Govt. Owned			Associated Wetlands Sharing a Border with a DNR Protected Water			Wetlands Not Protected By Govt. Ownership or Regulation			Percentage of Total Which are Protected-- ● Protected, ●● Associated with DNR Protected		
					Acres	Basins	Shoreline	Acres	Basins	Shoreline	Acres	Basins	Shoreline	Acres	Basins	Shoreline
Palustrine Emergent PEMA,A-D PEMB,B-D Palustrine Farmed P-F	Types I-II (Seasonally flooded or wet soils)	135.36	44	5,987.44	---	--	---	---	--	---	135.36	44	5,987.44	0%	0%	0%
Palustrine Emergent PEMC,C-D PEMF,F-D PEMU,U-D PEM/ASF Palustrine Open Water PEM/OWF POWF,F-X POWG	Types III-V (Shallow, Deep, and Open Marshes)	1735.75	409	86,669.37	● 311.30 ●● 166.47 ●●● 59.01 536.78	16 48 7 71	10,264.30 3,449.89 8,933.41 22,647.60	384.85	85	21,888.40	814.12	253	42,133.37	● 31% ●● 22% 53%	17% 21% 38%	26% 25% 51%
Lacustrine Littoral L2EMF L2EMG L2ABG	Types III-V (Shallow lakes)	18.75	8	1,173.34	● 6.29	2	382.00	---	--	---	12.46	6	791.34	34%	25%	33%
Lacustrine Limnetic L1OWH L1OWG	Type V (Lakes with deepwater habitat)	4505.63	14	40,114.75	● 4505.63	14	40,114.75	---	--	---	---	--	---	100%	100%	100%
Palustrine Scrub/Shrub PSS1/EMC /EMC,C-D /EMF,F-D PSS1C,C-D	Type VI (Scrub-Shrub)	67.85	26	3,862.51	● 3.33 ●● .49 3.82	1 1 2	189.65 53.29 237.94	---	--	---	64.03	24	3,624.57	6%	8%	6%
Palustrine Forested PFO1/EMC,C-D /EMF /SS1C PFO1B C,C-D PFO5/EMC E F	Type VII (Forested)	134.96	50	7,237.07	●● 3.82 ●●● 20.99 24.81	1 2 3	251.74 596.24 847.98	---	--	---	110.15	47	6,389.09	18%	6%	12%
Unassigned	Unknown	3.08	2	208.97	---	--	---	3.08	2	208.97	---	--	---	100%	100%	100%
TOTALS		6601.38	553	145,213.41	5077.45	92	64,263.41	387.93	87	22,097.37	1,136.12	374	58,925.81	● 77% ●● 6% 83%	17% 16% 33%	44% 15% 59%

North Dakota

Estimates of wetlands prior to settlement in North Dakota were about 5 million acres. Approximately 54 percent of this total remains today (SCS, 2/1980). Counties in the extreme eastern edge of the state have a very small percent of their original wetlands remaining while some counties in the Missouri Coteau have more than 80 percent of their original wetlands (Figure 2). The Soil Conservation Inventory of wet soils is considered to be the best available estimate of the original quantity of wetlands.

Bach, in a 1951 inventory for the North Dakota Game and Fish Department, reported about 1,014,000 depressions capable of holding water. He estimated 2.4 million acres under normal conditions and 3 million acres of surface water in an extremely wet year. A 1948 to 1951 USFWS inventory of natural basins found 664,000 basins with total wetland acreage of 2,152,000.

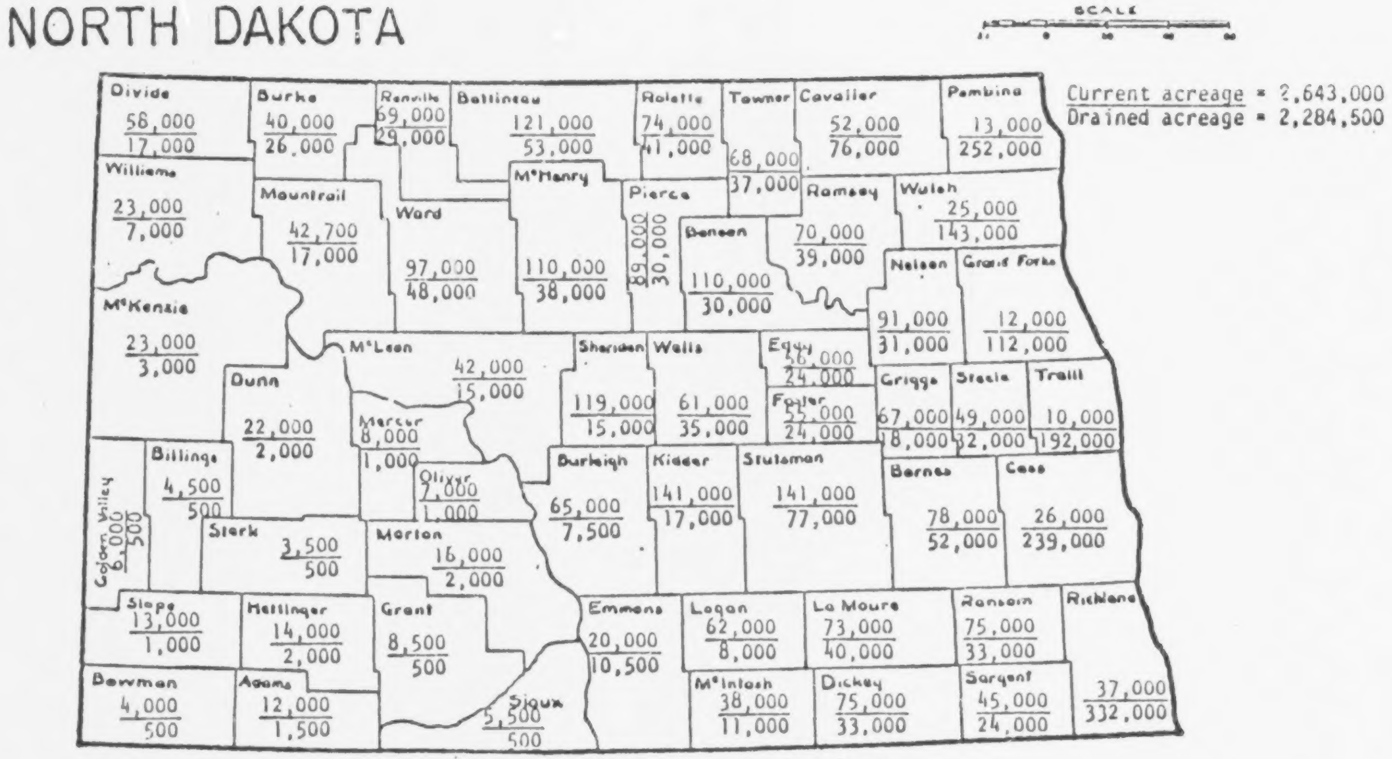
The 1955 USFWS inventory identified 1,523,265 acres of wetlands (Table 7). The majority of these wetlands were Types 3, 4, and 5.

TABLE 7. NORTH DAKOTA WETLAND ACREAGE BY TYPE FOR 1954

Wetland Type	Acres
1	248,106
2	12,949
3	498,069
4	460,730
5	303,411
Total	1,523,265

SOURCE: United States Department of the Interior, Fish and Wildlife Service. Wetlands Inventory of North Dakota. Office of River Basin Studies. Billings, Montana, March 1955.

ACREAGE ESTIMATE OF WET SOILS*


NORTH DAKOTA
SCALE
Current acreage = 2,643,000
Drained acreage = 2,284,500
Divide 58,000 17,000
Burke 40,000 26,000
Renville 69,000 29,000
Bottineau 121,000 53,000
Rolette 74,000 41,000
Towner 68,000 37,000
Cavalier 52,000 76,000
Pembina 13,000 252,000
Williams 23,000 7,000
Mountrail 42,700 17,000
Ward 97,000 48,000
McHenry 110,000 38,000
Pierce 89,000 30,000
Benson 110,000 30,000
Ramsey 70,000 39,000
Walsh 25,000 143,000
Nelson 91,000 31,000
Grand Forks 12,000 112,000
McKenzie 23,000 3,000
McLean 42,000 15,000
Sheridan 119,000 15,000
Wells 61,000 35,000
Eddy 56,000 24,000
Foster 55,000 24,000
Griggs 67,000 18,000
Steele 49,000 32,000
Traill 10,000 192,000
Dunn 22,000 2,000
Mercer 8,000 1,000
Oliver 7,000 1,000
Burleigh 65,000 7,500
Kidder 141,000 17,000
Stutsman 141,000 77,000
Barnes 78,000 52,000
Cass 26,000 239,000
Golden Valley 6,000 500
Billings 4,500 500
Stark 3,500 500
Morton 16,000 2,000
Slope 13,000 1,000
Hettinger 14,000 2,000
Grant 8,500 500
Emmons 20,000 10,500
Logan 62,000 8,000
La Moure 73,000 40,000
Ransom 75,000 33,000
Richland 37,000 332,000
Bowman 4,000 500
Adams 12,000 1,500
Sioux 5,500 500
McIntosh 38,000 11,000
Dickey 75,000 33,000
Sargent 45,000 24,000

*These soils have potential to produce vegetation typical of wetlands.

These data are based on soils mapped in North Dakota to 1980. Data from the counties where woils mapping is complete was expanded to make estimates in other counties.

The acreage drained figures are all estimates including the counties where soils mapping is completed. These estimates were considered important in order to provide a starting point useful for resource planning.

Figure 2. Acreage Estimate of Wet Soils

SOURCE: North Dakota Soil Conservation Service. February 1980. Long Range Plan, Bismarck.

A 1964 USFWS inventory of the PPR enumerated 317,000 wetlands which contained 1,468,000 acres. Stewart and Kantrud, 1967, estimated there were about two million acres of wetlands. They also estimated the composition of wetlands within the PPR (Table 8). Class 2 and 3 wetlands made up the largest number and the largest acreage.[5]

TABLE 8. DETAILED COMPOSITION OF WETLAND HABITAT TYPES IN THE PRAIRIE POTHOLE REGION OF NORTH DAKOTA, 1967

Habitat Type	Percent of Wetland Acreage	Percent of Number
Natural wetlands		
Basin wetlands		
Prairie ponds and lakes (with untilled bottom soils)		
Ephemeral ponds (Class I)	1	9
Temporary ponds (Class II)	2	9
Seasonal ponds (Class III)	33	21
Semipermanent ponds and lakes (Class IV)	18	3
Permanent ponds and lakes (Class V)	3	T[a]
Alkali ponds and lakes (Class VI)	6	T[a]
Fen ponds (Class VII)	T[a]	T[a]
Cropland ponds (with tilled bottom soils)		
Temporary ponds (Class II)	1	2
Seasonal ponds (Class III)	3	2
Undifferentiated tillage ponds (Class II and III)	25	48
Streams and oxbows	5	1
Man-made wetlands		
Stock ponds	T[a]	T[a]
Dugouts	T[a]	T[a]
Reservoirs and large impoundments	2	T[a]
Road ditches and drainage channels	T[a]	4
Other (sewage lagoons etc.)	T[a]	T[a]
Total	100	100

[a] T indicates 0.5 percent or less.

SOURCE: Stewart and Kantrud, 1967.

North Dakota Regional Environmental Assessment Program (REAP), produced a land cover inventory based on LANDSAT data from 1974 to 1976. Less than

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[5] Classes used by Stewart and Kantrud are essentially the same as Circular 39 Types, however they have included modifiers.

2 percent, 780,284 acres, of North Dakota was classified as wetlands (Table 9). A larger area, 1,265,812 acres, was designated as water.

Approximately two-thirds of North Dakota was inventoried via LANDSAT by the U.S. Army Corps of Engineers in 1978 (Table 10). Their estimates are substantially below the earlier LANDSAT figures. For example, LaMoure County had a total of 36,248 acres of water and wetland according to the REAP inventory and 15,024 acres in the Corps study. The most current state estimate by E. Podell, Soil Conservation Service, Bismarck, is 2,705,930 acres (Table 11).

A summary of 10 estimates of wetlands in North Dakota emphasizes the problem of consistency (Table 12). The inventories use different criteria, areas, and are affected by short term climatic factors. There is a high probability that the current National Wetlands Inventory will yield acreages higher than any previous inventory, due primarily to the detail contained in the inventory. Currently, the estimates by SCS are probably the most accurate, both for original and current acreage.

Both North Dakota Game and Fish Department and USFWS conduct annual waterfowl nesting inventories. These are done by transects across the state, NDGFD by north-south roads and USFWS by east-west aerial flights. These illustrate the high degree of variability due to short-run precipitation changes (Table 13). May counts by NDGFD have varied from 2.56 water holding ponds per mile to 13.25 during the last decade, 1973-1982. July counts of ponds by USFWS are only slightly more stable, varying from 1.919 per mile to 8.08 in the last decade. If any long term trend exists, it appears that the number of ponds may be higher from 1965 to 1982 than in prior years. Pond

TABLE 9. 1974-76 LANDSAT LAND COVER INVENTORY OF NORTH DAKOTA

Year of Images	County	Water	Wetland	County Total (acres)
1975	Adams	527	535	635,544
1975	Barnes	27,673	17,830	970,643
1976	Benson	38,453	434	925,592
1974	Billings	303	0	739,930
1974	Bottineau	24,937	18,268	1,088,737
1975	Bowman	2,674	388	747,370
1975	Burke	22,201	37,345	723,195
1975	Burleigh	27,749	913	1,067,455
1974-75	Cass	9,733	35,239	1,132,623
1976	Cavalier	14,731	8	969,014
1975	Dickey	14,679	13,413	730,003
1975	Divide	20,040	23,874	826,479
1975	Dunn	50,594	10,896	1,333,643
1976	Eddy	9,024	261	412,394
1976	Emmons	28,683	1,249	996,180
1976	Foster	4,480	6	414,909
1973-74	Golden Valley	44,466	6,993	645,508
1974-75	Grand Forks	4,511	10,951	920,828
1975	Grant	4,183	1,908	1,068,222
1975	Griggs	8,070	7,629	460,618
1975	Hettinger	686	1,023	724,324
1976	Kidder	33,853	2,974	918,726
1975	LaMoure	22,826	13,422	737,779
1976	Logan	10,504	1,603	647,346
1974-75	McHenry	24,209	7,656	1,225,480
1976	McIntosh	8,604	920	636,346
1974-75	McKenzie	66,781	5,300	1,828,896
1975	McLean	149,460	3,633	1,487,328
1975	Mercer	46,538	10,253	710,765
1974-75	Morton	14,682	8,866	1,242,924
1975	Mountrail	94,993	38,026	1,242,404
1975	Nelson	19,538	10,008	648,286
1975	Oliver	3,314	2	468,009
1974-75	Pembina	3,107	15,258	719,332
1976	Pierce	36,055	2,091	692,724
1976	Ramsey	72,102	36	832,325
1975	Ransom	7,354	99,629	552,774
1975	Renville	19,153	18,714	571,165
1975	Richland	6,865	121,370	927,822
1976	Rolette	39,315	5	601,548
1975	Sargent	5,915	118,094	557,007
1976	Sheridan	16,738	996	644,099
1975	Sioux	18,279	1,644	734,345
1973-75	Slope	913	2,356	759,571
1975	Stark	1,094	1,158	857,006
1975	Steele	4,844	9,103	457,626
1975	Stutsman	51,682	29,854	1,470,855
1976	Towner	12,679	3	667,245
1974	Traill	3,235	0	552,798
1974-75	Walsh	5,117	14,778	827,551
1975	Ward	43,325	41,230	1,318,600
1976	Wells	10,164	83	828,445
1974-75	Williams	54,177	12,056	1,375,212
	TOTAL	1,265,812	780,284	45,275,872

SOURCE: ND-REAP, 1977.

TABLE 10. LANDSAT INVENTORY OF NORTH DAKOTA, WETLANDS, 1978

County	Open Water	Marsh	Riparian	Total
Adams	974.52	360.20	13.44	1,348.16
Barnes	1,018.53	6,336.87	7.84	7,363.24
Benson	0.00	13.44	0.00	13.44
Billings	3,015.63	72.80	528.91	3,617.34
Bowman	4,943.14	935.15	160.35	6,038.64
Burke	9,258.58	2,997.21	4.48	12,260.27
Burleigh	20,136.76	5,837.98	410.61	26,385.35
Dickey	6,544.92	10,740.98	98.84	17,384.74
Divide	11,975.75	8,472.93	2.24	20,450.92
Dunn	41,399.59	1,860.85	340.13	43,600.57
Eddy	242.99	2,063.27	88.16	2,394.41
Emmons	31,321.95	4,278.59	29.12	35,629.66
Foster	1,537.97	7,889.62	247.65	9,675.24
Golden Valley	1,066.62	50.40	105.36	1,222.38
Grant	4,437.56	527.87	245.90	5,211.33
Hettinger	1,198.75	543.37	142.24	1,884.36
Kidder	34,085.42	13,532.50	14.56	47,632.48
La Moure	4,811.23	10,094.85	118.77	15,024.85
Logan	10,314.82	6,302.55	0.00	16,617.37
McHenry	111.52	58.41	0.00	169.93
McIntosh	11,766.95	5,137.75	0.00	16,904.70
McKenzie	62,753.37	2,535.33	1,570.51	66,859.21
McLean	127,441.78	8,134.18	234.01	135,809.97
Mercer	36,275.94	932.61	304.86	37,513.41
Morton	12,774.53	1,787.33	424.04	14,985.90
Mountrail	63,859.92	8,008.67	14.56	71,883.15
Oliver	5,264.44	444.25	460.42	6,169.11
Ransom	189.27	541.90	35.96	767.13
Sargent	1,274.58	2,651.39	0.00	3,925.97
Sheridan	4,657.94	2,344.92	0.00	7,002.86
Sioux	23,502.71	550.29	114.30	24,167.30
Slope	2,485.32	822.08	238.95	3,546.35
Stark	820.79	575.35	144.64	1,540.78
Stutsman	26,142.16	28,638.61	146.39	64,927.16
Ward	17,105.83	8,067.33	0.00	25,173.27
Wells	4,082.09	6,088.32	203.68	10,374.09
Williams	48,092.84	4,755.94	752.05	53,600.83
TOTAL	636,886.70	174,986.20	7,202.97	819,075.87

SOURCE: Corps of Engineers, 1978.

TABLE 11. SCS ESTIMATE OF WETLANDS IN NORTH DAKOTA, 1982

County		1 Land Area	2 Acres^1 Wetlands	3 Column 2/1 x 100
Benson	005	898,000	137,700	15
Cavalier	019	968,000	56,000	6
Eddy	027	406,000	52,500	13
Foster	031	413,000	51,800	13
G. Forks	035	920,000	17,500	2
Nelsom	063	637,000	86,250	14
Pembina	067	719,000	13,250	2
Ramsey	071	799,000	66,300	8
Towner	095	669,000	70,000	10
Walsh	099	823,000	25,500	3
Wells	103	831,000	42,250	5
A-1 TOTAL			619,050	
Barnes	003	947,000	87,000	9
Cass	017	1,119,000	27,200	2
Dickey	021	732,000	72,100	10
Griggs	039	454,000	63,200	14
LaMoure	045	727,000	77,000	11
Ransom	073	551,000	49,000	9
Richland	077	927,000	59,700	6
Sargent	081	546,000	40,800	7
Steele	091	454,000	49,400	11
Traill	097	551,000	10,100	2
A-2 TOTAL			535,500	
Bottineau	009	1,073,000	88,200	8
Burke	013	716,000	55,200	8
Divide	023	832,000	83,250	10
McHenry	049	1,203,000	108,750	9
Mountrail	061	1,164,000	88,560	8
Pierce	069	664,000	84,000	13
Renville	075	567,000	64,400	11
Rolette	079	584,000	71,500	12
Ward	101	1,308,000	89,700	7
A-3 TOTAL			733,560	
Burleigh	015	1,040,000	61,200	6
Emmons	029	962,000	19,720	2
Kidder	043	869,000	135,900	16
Logan	047	641,000	94,500	15
McIntosh	051	635,000	88,000	14
McLean	055	1,322,000	39,000	3
Morton	059	1,229,000	3,000	0.2
Oliver	065	461,000	5,925	1
Sheridan	083	633,000	114,300	18
Sioux	085	706,000	950	0.1
Stutsman	093	1,449,000	147,000	10
A-4 TOTAL			709,495	

- continued -

TABLE 11. SCS ESTIMATE OF WETLANDS IN NORTH DAKOTA, 1982 (CONTINUED)

County		1 Land Area	2 Acres[1] Wetlands	3 Column 2/1 x 100
Adams	001	633,000	4,800	1
Billings	007	729,000	475	0.06
Bowman	011	744,000	3,680	0.5
Dunn	025	1,275,000	8,000	1
G. Valley	033	649,000	570	0.06
Grant	037	1,066,000	1,800	0.2
Hettinger	041	726,000	5,250	1
McKenzie	053	1,750,000	6,300	0.3
Mercer	057	667,000	8,250	1
Slope	087	784,000	11,900	2
Stark	089	842,000	3,000	0.3
Williams	105	1,321,000	54,000	4
A-5 TOTAL			108,025	
TOTAL			2,705,930	

[1] Includes Type 1 wetlands which are not eligible for Water Bank Program. Estimates based on soils information by E. Podoll.

SOURCE: Soil Conservation Service. United States Department of Agriculture, 1982.

TABLE 12. COMPARISON OF WETLAND INVENTORIES FOR NORTH DAKOTA

Year		Source	Wetland Acreage
1	Original	SCS	4,927,500
2	1951	Bach	2,368,651 --> 3,000,000
3	1948-51	USFWS[a]	2,152,000
4	1955	USFWS[b]	1,523,265
5	1964	USFWS[c]	1,468,000
6	1967	Stewart & Kantrud[d]	2,000,000
7	1974-76	REAP	780,284+ 1,265,812 water
8	1978	USC of E	819,076
9	1980	SCS	2,643,000
10	1982	SCS	2,705,930

[a] Included only natural basins.
[b] Included only natural basins north and east of the Missouri River.
[c] Same as the 1955 inventory plus Dunn and Mercer counties.
[d] Includes Prairie Pothole Region only.

SOURCES: 1) SCS, 1980; 2) Bach, unpublished, files of NDGFD; 3) USFWS, 1955; 4) USFWS, 1955; 5) USFWS, unpublished, 1964; 6) Stewart & Kantrud, 1973; 7) REAP, 1977; 8) USC of E, 1981; 9) SCS, 1980; 10) SCS, 1982.

TABLE 13. WATER AREAS INDICES PER SQUARE MILE IN NORTH DAKOTA FROM AUTO AND AERIAL TRANSECTS, 1948-1982

	May[1]	July[2]		
		Units*		
Year	North Dakota	45	46	48
1948	3.99			
1949	5.81			
1950	11.38			
1951	7.44			
1952	3.95			
1953	6.09			
1954	3.39			
1955	4.86			
1956	6.47			
1957	3.91			
1958	4.55	2.472	3.333	
1959	2.07	1.037	1.222	.757
1960	5.43	2.694	2.733	2.330
1961	2.38	.519	.533	1.316
1962	4.76	2.185	4.667	4.831
1963	5.07	5.287	4.311	4.564
1964	4.54	3.880	4.756	3.025
1965	10.94	5.028	4.933	3.384
1966	14.56	4.747	5.467	3.111
1967	11.18	5.067	6.418	5.663
1968	8.95	3.440	7.830	3.682
1969	9.61	11.021	10.156	7.822
1970	14.57	10.744	5.644	4.000
1971	6.67	8.670	5.474	4.787
1972	12.35	7.177	4.037	5,248
1973	3.64	4.908	1.719	3.092
1974	13.35	7.311	3,126	2.482
1975	11.20	8.006	10.926	3.283
1976	6.85	8.0837	4.4519	2.6032
1977	2.56	2.6731	2.9109	1.7589
1978	9.26	3.9163	4.5259	4.0889
1979	11.99	5.8873	4.6370	2.4952
1980	3.18	1.919	2.126	1.352
1981	3.20	3.6006	2.4593	1.5238
1982	11.70			

*45 = North Central North Dakota, 46 = South Central North Dakota, and 48 = North Central South Dakota.

SOURCES: [1] Michael A. Johnson. Waterfowl Breeding Ground Survey. North Dakota State Game and Fish Department. Paper No. 803, November 1981.

[2] United States Fish and Wildlife Service. "Annual July Pond and Brood Index Summary Form, 1958-1982."

counts are not meant to be an indicator of wetland trends, however they do illustrate the difficulty of obtaining accurate inventory data.[6]

The USFWS has conducted an annual drainage survey since 1966. A sample area of 48,700 acres was chosen from the 1964 inventory (Table 14). It included wetlands from each of the three states in the PPR. Drainage of unprotected wetlands totaled 14 percent in Minnesota, 5 percent in North Dakota and less than 2 percent in South Dakota from 1966 to 1968 (Haddock and Debates, 1969). Land protected under permanent easement or purchase, 4,100 acres, was excluded when calculating drainage rates. Over 2,200 acres were drained from the North Dakota base of 20,844 acres over a 14 year period. Type 1 wetlands were excluded from this analysis, so the drainage rates are low. Previous inventory data indicate that Type 1 wetlands comprise about 10-15 percent of the total wetland acres and 60 percent of total wetland numbers in the PPR (Haddock and Debates, 1969).

TABLE 14. RATE OF WETLAND DRAINAGE IN PPR

		Annual Percentage Rate Drained		
Years	Acres	Minnesota	North Dakota	South Dakota
1964 Base = 48,700 acres				
1964-66	614	3.17	1.43	.05
1966-67	1,090	4.9	2.25	1.13
1967-68	826	5.25	1.92	.12
1966-80	2,205.8[a]		.8	

[a] North Dakota acreage only.

SOURCE: Haddock & Debates, 1969 and USFWS, 1980, memorandum.

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[6] Pond counts include each individual depression containing water at the time of survey regardless of size or permanency. This can lead to anomalies such as fewer ponds in wet than dryer years. An area may have two or three small ponds in a dry or normal year which in a wet year may be one large pond.

Two major reasons were given for the decline in drainage rates in North Dakota. First, the base decreases as previously drained acreage is removed and additional wetlands are protected. Much of the less costly land to drain is subtracted from the base in this way. The second reason is that USFWS suspects the study is becoming an unreliable indicator of drainage over time. For example, drainage based on a sample of 7,986 acres in the Minot, North Dakota, area was 0.24 percent annually from 1966 to 1980. USFWS personnel from the J. Clark Salyer National Wildlife Refuge, near Minot, documented drainage activity on 560 quarter sections near the Refuge in 1976. Few, if any, of the landowners had secured permits from the state for this activity.[7] Drainage activity is difficult to estimate according to USFWS personnel as it is highly variable from year to year and by location. They stated that an area may have very low drainage rates for a substantial length of time, yet experience high rates, 5 to 10 percent annually for a couple years. Part of this phenomena is related to economic and climatic conditions, such as the drainage near J. Clark Salyer National Wildlife Refuge in 1976. Another important factor is a localized event where one landowner begins the drainage process and his neighbor joins the activity. Presence of drainage equipment in the area may help stimulate the "bandwagon" effect.

South Dakota

The 1954 inventory by USFWS estimated 751,988 acres of Types 1 through 5 wetlands (Table 15). The 1964 USFWS inventory was more complete, identifying 1,381,475 acres of wetlands (Table 16). This inventory was revised in 1974 to account for drainage losses. Only 1,332,562 acres were found (USFWS, 1975).

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[7] Documentation of this drainage activity was transmitted to the North Dakota State Water Commission; this issue is discussed in more detail in a later section.

TABLE 15. SOUTH DAKOTA WETLAND ACREAGE BY TYPE, 1954

	Wetland Type	Acres
Total South Dakota	1	105,122
	2	134,920
	3	244,816
	4	87,186
	5	179,944
	Total	751,988
East of Missouri River	1	77,021
	2	131,831
	3	217,809
	4	82,202
	5	172,153
	Total	681,016
West of Missouri River	1	28,101
	2	3,089
	3	27,007
	4	4,984
	5	7,791
	Total	70,972

SOURCE: United States Department of the Interior, Fish and Wildlife Service. *Wetlands Inventory of South Dakota*. Office of River Basin Studies. Billings, Montana, December 1954.

Ruwaldt *et al*. estimated 1,089,955 acres of natural prairie potholes in 1973 and 1974. When streams, manmade dugouts, and stock ponds were included, the acreage estimate increased to 1,444,793. Subtraction of drainage estimates from the 1964 inventory results in a 1982 estimate of 1,296,207 acres (Wittmier, 6/1982).

The Corps of Engineers LANDSAT inventory in 1978 yielded a total of 1,150,323 acres of wetlands (Corps of Engineers, 5/1981). These data are available by county, however even though the total acreage is reasonably close to USFWS data, comparison to the 1975 revision of the 1964 USFWS inventory

TABLE 16. INVENTORY, TYPES 1, 3, 4, AND 5 WETLANDS, SOUTH DAKOTA (1975 REVISION OF THE 1964 WETLAND INVENTORY)

County	Total Type 1, 3, 4, and 5 Wetland Acres
East River Counties	
Aurora	31,925
Beadle	39,990
Bon Homme	5,331
Brookings	22,255
Brown	40,301
Brule	21,113
Buffalo	2,679
Campbell	28,709
Charles Mix	35,399
Clark	62,086
Clay	523
Codington	42,194
Davison	7,603
Day	89,968
Deuel	25,189
Douglas	19,777
Edmunds	100,003
Faulk	91,863
Grant	13,039
Hamlin	38,346
Hand	61,647
Hanson	10,995
Hughes	5,111
Hutchinson	11,084
Hyde	25,785
Jerauld	12,849
Kingsbury	69,861
Lake	37,420
Lincoln	2,479
Marshall	48,234
McCook	24,632
McPherson	82,002
Miner	27,129
Minnehaha	11,309
Moody	3,918
Potter	15,536
Roberts	50,498
Sanborn	28,242
Spink	22,311
Sully	23,165
Turner	6,518
Union	2,991
Walworth	13,077
Yankton	4,976
East River Counties Subtotal	1,320,062

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TABLE 16. INVENTORY, TYPES 1, 3, 4, AND 5 WETLANDS, SOUTH DAKOTA (1975 REVISION OF THE 1964 WETLAND INVENTORY) (CONTINUED)

County	Total Type 1, 3, 4, and 5 Wetland Acres
West River Counties	
Bennett	10,559
Corson	6,623
Dewey	11,914
Haakon	2,856
Jackson	255
Jones	4,346
Lyman	11,244
Stanley	2,065
Todd	1,022
Tripp	6,463
Ziebach	4,066
West River Counties Subtotal	61,413
GRAND TOTAL	1,381,475

SOURCE: United States Department of the Interior. "Revised 1964 Wetland Inventory of South Dakota." Fish and Wildlife Service. Area Office: Pierre, South Dakota, 1975.

shows major differences. For example, Aurora County contains 31,925 acres (USFWS) or 8,015 acres (Corps of Engineers) of wetlands. Dewey County contains 11,914 acres according to USFWS and 89,268 wetland acres in the Corps of Engineers inventory. Major differences are due to the apparent inclusion of reservoirs by the Corps and not identifying many Type 1 and 2 wetlands.

South Dakota has had lower drainage rates recently than either of the other two states in the PPR. High drainage rates occurred in some areas in southeastern South Dakota prior to 1960. Burwell and Sugden (1964) estimated about 1,400 wetlands with 6,285 acres had been drained in Day County by 1949. Sixty-two percent, 238 of 385 wetlands in Farmington Township, Lake County, had been drained by 1961. This may have major impacts on waterfowl production, Sanderson (1976) estimated that the PPR may only produce one-third as many ducks today as it did under pristine conditions.

TABLE 17. CORPS OF ENGINEERS LANDSAT INVENTORY OF SOUTH DAKOTA LAND COVER

County	Open Water	Marsh	Riparian	Subirrigated Meadow	Total
Aurora	5,215.25	2,781.06	19.04	0.00	8,015.35
Beadle	7,649.64	5,801.08	194.79	0.00	12,745.51
Bennett	4,189.97	1,613.90	8.96	10,780.24	16,593.07
Bon Homme	12,853.17	908.46	797.82	0.00	14,559.45
Brookings	8,819.61	2,845.53	182.47	0.00	11,847.61
Brown	26,918.00	16,886.82	1,065.63	0.00	44,871.61
Brule	18,841.25	5,536.19	20.27	0.00	24,396.71
Buffalo	11,322.15	1,305.86	1.12	0.00	12,629.13
Butte	12,920.93	2,190.88	311.10	0.00	15,422.91
Campbell	23,252.07	4,296.75	54.88	0.00	27,603.70
Charles Mix	45,554.09	3,582.24	978.01	0.00	50,114.34
Clark	18,415.61	15,141.49	0.00	0.00	33,557.10
Clay	3,040.13	190.40	166.88	0.00	3,397.41
Codington	22,631.44	6,860.45	46.12	0.00	29,538.01
Corson	38,493.35	2,804.01	686.10	0.00	41,983.46
Custer	989.67	215.24	238.74	0.00	1,443.65
Davison	1,825.71	508.51	160.40	0.00	2,494.62
Day	25,817.86	7,973.59	38.08	0.00	33,829.53
Deuel	3,987.29	1,503.49	105.28	0.00	5,596.06
Dewey	85,383.55	3,744.48	140.00	0.00	89,268.13
Douglas	1,741.19	1,531.80	13.44	0.00	3,286.43
Edmunds	17,112.97	24,090.91	59.36	0.00	41,263.24
Fall River	7,038.88	705.52	547.63	0.00	8,292.03
Faulk	8,166.97	9,509.15	22.40	0.00	17,698.52
Grant	603.02	181.98	0.00	0.00	785.00
Gregory	18,159.09	732.44	77.77	0.00	18,969.30
Haakon	6,875.13	985.20	374.80	0.00	8,235.13
Hamlin	23,547.90	5,405.88	32.48	0.00	28,986.26
Hand	6,733.84	5,858.33	14.56	0.00	12,606.73
Hanson	3,173.74	1,979.06	224.18	4,276.57	9,653.55
Harding	7,308.97	1,755.21	241.92	0.00	9,306.10
Hughes	37,784.20	2,902.20	120.04	0.00	40,816.44
Hutchinson	4,337.96	1,406.96	225.76	0.00	5,970.68
Hyde	6,043.70	3,030.00	1.12	0.00	9,074.82
Jackson	2,606.49	182.56	59.36	0.00	2,848.41
Jerauld	1,083.54	1,877.36	0.00	0.00	2,960.90
Jones	4,237.50	1,918.96	69.44	0.00	6,225.90
Kingsbury	24,480.37	8,709.50	0.00	0.00	33,189.87
Lake	10,742.04	3,622.79	16.80	0.00	14,381.63
Lawrence	157.79	59.34	23.52	0.00	240.65
Lincoln	565.21	128.80	173.31	0.00	867.32
Lyman	47,934.68	10,315.72	250.03	0.00	58,500.43
Marshall	14,703.06	6,424.17	24.64	0.00	21,151.87
McCook	3,418.24	4,208.35	0.00	0.00	7,626.59
McPherson	14,391.29	18,613.53	104.16	0.00	33,108.98
Meade	6,160.28	947.93	1,959.24	0.00	9,067.45

- continued -

TABLE 17. CORPS OF ENGINEERS LANDSAT INVENTORY OF SOUTH DAKOTA LAND COVER (CONTINUED)

County	Open Water	Marsh	Riparian	Subirrigated Meadow	Total
Meldette	3,738.79	1,490.91	285.60	0.00	5,515.30
Miner	2,264.77	3,148.62	0.00	0.00	5,413.39
Minnehaha	3,813.90	2,018.81	51.00	0.00	5,888.71
Moody	824.86	942.44	6.72	0.00	1,774.02
Pennington	5,198.30	447.63	717.11	0.00	6,363.04
Perkins	8,641.74	1,891.93	101.92	0.00	10,635.59
Potter	25,730.85	4,091.20	6.72	0.00	29,828.77
Roberts	2,472.60	969.43	0.00	0.00	3,442.03
Sanborn	2,482.13	2,930.94	225.63	0.00	5,638.70
Shannon	2,144.83	125.44	61.63	0.00	2,362.15
Spink	11,407.47	8,568.77	1,163.11	0.00	21.139.35
Stanley	45,917.41	2,042.37	77.72	0.00	48,037.50
Sully	42,898.86	2,430.69	13.44	0.00	45,342.99
Todd	1,787.84	1,038.06	68.32	10,096.71	12,990.93
Tripp	2,902.32	1,621.59	720.73	0.00	5,244.64
Turner	984.25	1,875.91	347.20	0.00	3,207.36
Union	3,763.22	77.28	353.77	0.00	4,194.27
Walworth	27,376.61	4,752.63	216.83	0.00	32,346.17
Washabaugh	1,962.37	229.67	21.28	0.00	2,213.32
Yankton	5,572.08	872.80	448.54	0.00	6,893.42
Ziebach	5,437.27	950.57	473.09	0.00	6,860.93
TOTAL	863,652.15	246,290.77	15,227.00	25,153.52	1,150,323.44

SOURCE: U.S. Army Corps of Engineers. May 1981. *Wetland Atlas of the Omaha District, Missouri River Division*. Omaha, Nebraska.

Annual drainage rates in the South Dakota PPR were 0.05 to 1.13 percent from 1964 to 1968 (Haddock & Debates, 1969). Only 3.5 percent of 1964 wetlands were drained from 1964 to 1974. In the fall of 1980, USFWS updated the drainage survey and found 4.4 percent of the seasonal and semipermanent wetland acreage unprotected at the end of 1974 had been drained between 1974 and 1980 (USFWS, 12/1980). The southeastern portion of the state, within the Corn Belt, had experienced substantially more drainage, 7.6 percent, than the northeastern part, 1.5 percent during the 1974 to 1980 period.

III. FACTORS RELATED TO WETLAND TRENDS

Economic Relationships

Nearly all persons interviewed (Appendix A) stated that economic factors were the major reason for drainage of wetlands. In the Prairie Pothole Region, this means the agricultural economic situation, i.e., net returns per acre and per farm unit. Higher net returns are followed by higher wetland drainage activity for several reasons:

1) The opportunity cost of maintaining wetlands increases as the difference between the return from wetlands in their natural state and the income foregone from crop production becomes larger.
2) Higher profit levels provide funds to invest in drainage activity without explicit borrowing or interest costs.
3) An increase in net farm income can be obtained by expanding cultivated land area. Normal methods are purchase or leasing of cropland, or drainage of wetlands.

Production Costs and Revenues

One respondant stated that peaks in drainage activity occur under the following conditions: 1) high net farm income which provides funds for investing in drainage activities; 2) a wet year with lots of potholes which increases the irritation factor to stimulate drainage and; 3) a dry year following the prior two events to allow low cost drainage and fill operations.

Several respondants stated that drainage activity was quite low during the last few years. This is supported by the ratio of prices received to prices paid (Table 18).[8] Although not documented by hard data, the period from

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[8] U.S. Department of Agriculture compiles information on a set of prices received by farmers for their commodities and a set of prices paid for a typical " market basket" of inputs bought and transforms these into an annual index.

TABLE 18. RATIO OF PRICES RECEIVED TO PRICES PAID, 1950-1981 (1967 = 100)

1950	1.43
1951	1.37
1952	1.43
1953	1.44
1954	1.42
1955	1.41
1956	1.40
1957	1.27
1958	1.21
1959	1.16
1960	1.17
1961	1.24
1962	1.31
1963	1.20
1964	1.08
1965	1.04
1966	1.02
1967	1.02
1968	.96
1969	.87
1970	.87
1971	.80
1972	.81
1973	1.36
1974	1.90
1975	1.52
1976	1.18
1977	0.89
1978	0.84
1979	0.87
1980	0.96
1981	

SOURCES: North Dakota Crop and Livestock Reporting Service.
Crop Reporting Board, Statistical Reporting Service. Index Numbers of Prices Received and Prices Paid By Farmers. U.S. Department of Agriculture, Washington, D.C., May 28, 1976.
Crop Reporting Board, Statistical Reporting Service. Annual Price Summary. U.S. Department of Agriculture, Washington, D.C., June 1981.

1973 through 1976 was stated to be the recent high point of drainage activity (Appendix B). Much of this drainage involved wetland Types 1 and 2, and did not involve drainage permits.

Land Values

Expansion of land areas, particularly cropland acreage, is a primary means of increasing gross and net farm income. Cropland controlled by a farmer can be expanded through purchase, cash or share lease, and conversion of noncropland to crop use. Drainage of wetlands is a frequently used method of expansion. The comparative economic advantage of these expansion methods depends on costs and returns of each alternative. Land value represents the cost of expansion through purchase (Tables 19, 20, and 21). In Minnesota, land prices increased slowly from 1950 to 1968. Since 1974, however, prices have increased at a rapid pace. The result has been a five fold increase in land price from 1968 to 1979. Increases in North and South Dakota have also been substantial during the decade of the Seventies, although not as rapid as in Minnesota.

Land values were frequently mentioned by federal and state respondants as a factor in stimulating drainage. The implicit assumption is that drainage costs have not risen as rapidly as land costs, thus increasing the absolute and comparative advantage of drainage over purchase as a means of expanding farm size.

Drainage Costs and Returns

A major factor affecting a landowner's decision to preserve or drain is the economic return from drainage of wetlands.

Costs of drainage in the Devils Lake region of North Dakota were estimated to be $11.24, $14.18, and $18.56 (1974 dollars) for wetlands which hold water only in early summer, until midsummer, and all year, respectively. (Leitch and Scott, 1977). These estimates were based on open ditch drainage cost estimates from survey data collected from operators who had drained wetlands, primarily with their own equipment.

TABLE 19. AVERAGE ESTIMATED VALUE PER ACRE OF FARM REAL ESTATE IN MINNESOTA BY DISTRICTS FOR 1950 TO 1979[a]

Year	Southwest	West Central	Northwest	Minnesota
1950	141	76	46	85
1951	166	89	54	99
1952	175	96	68	107
1953	175	95	64	105
1954	187	99	72	113
1955	205	103	73	121
1956	214	107	76	126
1957	230	122	86	138
1958	242	123	90	147
1959	255	134	103	157
1960	248	133	99	155
1961	247	133	100	156
1962	250	138	104	159
1963	246	142	114	161
1964	252	145	115	166
1965	261	146	113	171
1966	277	153	112	183
1967	303	163	108	194
1968	333	181	122	211
1969	350	196	120	223
1970	347	198	120	227
1971	351	204	119	232
1972	379	208	117	248
1973	459	247	146	298
1974	675	378	199	423
1975	844	503	295	525
1976	1,106	624	378	667
1977	1,316	730	427	794
1978	1,421	803	483	889
1979	1,620	883	599	1,040

[a] The prairie pothole region is concentrated in West Central Minnesota, but also includes parts of the Southwest and Northwest. The Minnesota average also includes three other districts.

SOURCE: David Henneberry, Philip M. Raup, The Minnesota Rural Real Estate Market in 1979. Department of Agricultural and Applied Economics, Institute of Agriculture, Forestry, and Home Economics. University of Minnesota, St. Paul, Minnesota 55108. March 1980, Economic Report ER 79-3.

TABLE 20. ESTIMATED AVERAGE FARMLAND VALUES PER ACRE IN NORTH DAKOTA FARMING AREAS FOR 1950 TO 1981

Year	State	Central	3A[1]	2B[1]	3B[1]	Northwest Central	Northeast Central	Southwest Central	Southeast Central
1950									
1951									
1952									
1953									
1954[a]	36								
1955									
1956									
1957									
1958[a]	51								
1959[b]		48							
1960[c]		50							
1961[d]		52							
1962[e]			57	41	59				
1963			69	51	67				
1964			70	52	71				
1965			75	54	82				
1966			84	55	81				
1967			96	62	89				
1968			102	64	96				
1969			110	67	96				
1970			105	67	96				
1971			107	68	98				
1972			112	74	110				
1973			155	115	145				
1974			180	135	250				
1975			260	200	305				
1976			285	225	340				
1977						280	365	245	358
1978						291	410	273	396
1979						338	519	295	440
1980						355	533	303	519
1981						355	615	315	540

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[1] Areas roughly compare in the following manner: 1) 3A to Northwest Central; 2) 2B to Southwest Central; and 3) 3B to Southeast Central.

SOURCES: [a] Laurel D. Loftsguard and Thomas K. Ostensen. "Farm Values--The Trend is Up in North Dakota." North Dakota Farm Research. Vol. 20, No. 10.

[b] Marvin J. Lembke and Laurel D. Loftsguard. "North Dakota Farmland Values in 1959." North Dakota Farm Research. Vol. 21, No. 4.

[c] Marvin J. Lembke and Laurel D. Loftsguard. "Land Prices Continue Up in 1960." North Dakota Farm Research. Vol. 21, No. 10.

[d] Donald E. Anderson and Duane Aljoe. "Farm Real Estate." North Dakota Farm Research. Vol. 22, No. 4.

[e] Years 1962-1981. Jerome E. Johnson. "Farmland Values." North Dakota Farm Research. Bimonthly Bulletin, Vol. 23, No. 10; Vol. 25, No. 5; Vol. 29, No. 5; Vol. 34, No. 4; Vol. 39, No. 4.

TABLE 21. FARM REAL ESTATE VALUES: AVERAGE VALUE PER ACRE OF LAND AND BUILDINGS FOR 1950 TO 1981, SOUTH DAKOTA

Year	
1950[a]	31
1951	36
1952	41
1953	40
1954	38
1955	40
1956	40
1957	42
1958	46
1959	51
1960	51
1961	52
1962	55
1963	59
1964	62
1965	62
1966	69
1967	74
1968	80
1969	83
1970[b]	84
1971	85
1972	87
1973	94
1974	119
1975	145
1976	163
1977	194
1978	227
1979	256
1980	273
1981	290

[a] Years 1950-1970. *Farm Real Estate Historical Series Data: 1850-1970.* United States Department of Agriculture. Economic Research Service, ERS 520, June 1973.

[b] Years 1970-1981. *Farm Real Estate Market Developments--Outlook and Situation.* United States Department of Agriculture. Economic Research Service, CD-86, August 1981.

Estimates of open ditch drainage costs ranging from $21 to $400 per drained acre were obtained from a survey of 137 operators in Minnesota (Leitch and Danielson, 1979). The source of variation in drainage costs was hypothesized to be due solely to differences in selected wetlands characteristics and topographic setting. Forty-eight of the operators had drained wetlands, the majority through open ditch drainage.

Goldstein estimated an average of $50 for open ditch and $157 per drained acre for tile drainage in southern Minnesota (1971 dollars). Variation in cost was high, ranging from $16 to $111 for open ditch and $124 to $228 for tile drainage systems. He estimated yield increases over similar undrained land of 43 bushels for corn, 18 bushels for soybeans, and 15 bushels for wheat.

Partial budgets were used in a detailed study of drainage costs in Minnesota (U.S. Army Corps of Engineers, 1981). The budgets included gross returns, production costs, and amortized drainage costs. Drainage costs ranged from $35 to $260 per wetland acre. Variation was due to size of wetland and topography. Annual net returns in the PPR varied considerably, with a high of +$29 to a low of -$10 per drained acre. Inclusion of property tax effects (including Minnesota's tax credit) and state and federal income taxes were occasionally large enough to offset a before tax loss on the drainage investment. In the PPR, net returns per year after taxes ranged from $0 to $20 per acre with few exceptions. Income tax generally had the effect of reducing losses where before tax returns were negative and decreasing gains in areas where before tax returns were positive. Deductions for drainage costs occur sooner than returns, thereby resulting in a positive effect in early years.

Large variation in drainage costs were found both within individual studies and between studies (Table 22). The lowest costs by far, were

TABLE 22. SUMMARY OF DRAINAGE COST ANALYSES

	Wetland Type	Drainage Type	Drainage Costs[1] Per Acre
1) Southern Minnesota, 1971	1	Surface	$11.24
	2	Surface	$14.18
	3	Surface	$18.56
2) Devils Lake North Dakota, 1976		Surface	$ 16 - $ 111
		Tile	$124 - $ 228
3) West Central Minnesota, 1979		Surface	$ 21 - $ 400
		Tile	$250 - $ 371
4) Southern Minnesota, 1981		Tile	$350 - $ 440
5) Western Minnesota, 1981		Surface	$ 35 - $ 200
6) West Central Minnesota, 1981		Surface	$165 - $ 383
		Tile	$516 - $1,046
7) South Central Minnesota, 1981		Tile	$425 - $ 529

[1] Cost-share by USDA, if any, was apparently included. None of the studies directly attempted to quantify the impact of this program.

SOURCES: 1) Leitch and Scott, 1977; 2) Goldstein, 1971; 3) Leitch and Danielson, 1979; 4 and 5) USC of E, 1981; and 6 and 7) Leitch and Danielson, 1981.

estimated in the Devils Lake basin. These estimates were obtained from farm operators who primarily used their own equipment. Leitch and Kerestes computed coefficients of variation of 1.11 to 1.18 for West Central Minnesota surface and tile drainage. Depth and length of ditch, the size of the wetland to be drained, presence or absence of an outlet, and ownership of equipment were mentioned in these studies as the major determinants of cost.

The effect of stream channelization on subsequent wetland drainage was analyzed by Erickson (1975). He found that nearly three times more basins and seven times more wetland acres were drained in the channelized area after than before channelization. Much of the drainage occurred after approval of the work plan. He concluded that the presence of an adequate outlet was the major factor influencing decisions by landowners to drain.

The net after tax return to drainage was compared to payments under four preservation incentive programs. The annual before tax payments in Minnesota vary from $1 to $4 for Minnesota wetlands property tax exemption and credit,[9] $8 to $10 for Federal Water Bank, $10 to $35 for U.S. Fish and Wildlife perpetual easements and $15 to $45 per acre for the Minnesota Water Bank program.[10] Individually, the USFWS easements and the Minnesota Water Bank Program were sufficient to compensate landowners for income foregone due to wetland preservation. In eligible Minnesota counties, landowners can receive property tax exemption and credit, and payment from preservation programs. The same wetland may be under a USFWS easement and the Federal Water Bank program. It appears that a landowner can legally participate in the tax exemption and credit plus both federal programs simultaneously, thus obtaining $19 to $47 per acre of wetland preserved or both state programs.

Wetlands in North and South Dakota can be enrolled in both federal programs, yielding $25 to $55 per acre revenue. Compensation appears to be adequate to cover net returns to drainage in each of the states. Leitch and Danielson point out that there is a wide variation in drainage costs, depending on the type of wetland, local topography, and type of ditching equipment used, therefore necessary compensation will also be highly variable.

None of the analyses considered income which may be received from the wetland via forage production, lease of hunting rights, or trapping of furbearers. Wetland costs associated with weed infestations, damage to surrounding cropland from wildlife, avoidance costs, and possible machinery damage or delays from being mired in wet areas were also not considered in the studies.

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[9] After tax effect of these programs were estimated to range from $6 to $12 per acre.

[10] This was a projected payment range, actual range, as noted on page 66, is from $85 to $125.

Technology Change

Change in farming methods, increased specialization in crop production, decrease in the number of farms with livestock, and increasing machinery size were mentioned by most of the respondents as major causes of wetland drainage. These changes have decreased the relative value of wetlands as a source of forage and increased soil erosion which gradually fills and decreases the wildlife value of the wetland. The increase in machinery size has simultaneously provided the horsepower to perform much of the drainage activity and increased the avoidance costs of farming around potholes.[11]

Composition of farm tractor sales is a good indicator of changing farm technology. Retail sale trends of farm tractors in North Dakota indicate a rapid increase in horsepower (Table 23). Tractors of over 100 horsepower were less than one-third of total sales in 1967. The percentage of large to total tractors sold jumped to 84 percent by 1975 and reached 93 percent in 1980. The significance of this change is more than just increasing tractor size, as the size of the largest tractor on the farm determines the type and width of major tillage equipment. In a study of avoidance costs of electrical transmission towers, machinery width was the key factor determining the cost of avoiding towers placed in cropland (Gronhovd, 1982). Avoidance of prairie potholes would exhibit a similar relationship between costs and machinery size.

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[11] Any obstacle within a cultivated field causes the farmer to increase distance traveled and overlap on previously cultivated land to avoid it. This distance can be translated into increased cost which does not generate income.

TABLE 23. RETAIL SALES OF FARM WHEEL TRACTORS IN NORTH DAKOTA BY HORSEPOWER CLASS, 1967-80

Year	Horsepower Class					Total[a]
	100-109	110-119	120-129	130-139	140-over	
	number sold					
1967	100		1,046			3,819
1968	h.p. &		958			3,375
1969	over		1,524			3,444
1970	531	298	236	174	168	2,747
1971	303	401	146	343	375	2,598
1972	253	700	248	463	776	3,504
1973	466	319	952	255	1,559[c]	4,807
1974	398	138	1,055	106	1,931[c]	4,439
1975	604[b]		898	159	2,787[c]	5,273
1976	368[b]		657	165	1,980[c]	3,584
1977	290[b]		394	346	1,069[c]	2,336
1978	408[b]		140	889	1,664[c]	3,401
1979	371[b]		188	749	1,949[c]	3,562
1980	236[b]		149	540	1,460[c]	2,579

[a] Total includes those tractors sold under 100 horsepower also.

[b] 100-119 horsepower class.

[c] Includes all four-wheel drive tractors of which a small number are under 140 h.p.

SOURCE: Implement and Tractor, Intertec Publishing Corporation, monthly issues, Kansas City, Missouri.

The large horsepower tractor also provides the vehicle to mount dozer blades and buckets, and to pull small to medium size earth moving equipment. Although no data is available on the exact numbers, these types of equipment are seen with increasing frequency on farms in the PPR. Farmers can perform earth moving activities during slack seasons with much lower cash costs than hiring custom operators. The substantially lower costs reported in the Devils Lake region were due to this factor (Leitch and Scott, 1977).

A gradual increase in center pivot irrigation systems also has an effect on prairie potholes (Table 24). Each system covers nearly 160 acres. They rotate on sets of rubber tires which are not able to cross wetlands. Two

TABLE 24. IRRIGATED ACRES IN NORTH DAKOTA, 1974-1981

Year	Irrigated Acres
1974	78,204
1975	91,910
1976	102,810
1977	134,310
1978	150,110
1979	164,610
1980	182,930
1981	198,510

SOURCE: Irrigation Age, various issues.

alternatives to eliminate the wetland problem are used: 1) building of an earth bridge across the pothole; and 2) drainage and/or filling of the pothole. Due to the relatively small proportion of land under irrigation in the PPR, irrigation is not a major cause of drainage at this time. However, the quantity of irrigated land is increasing, continuing to stimulate on wetland drainage.

Climatic Changes

Effects of climatic change can be divided into short term and long term effects. Short term precipitation levels have a dramatic and predictable effect on wetlands. As documented previously in this report, the number of ponds per mile varies greatly from year to year depending on precipitation rates. Annual precipitation in the PPR is quite unstable, ranging from 9 to 28 inches during the past two decades (Table 25). This greatly complicates the inventory process, particularly for Types 1 and 2 wetlands which appear and disappear with changes in precipitation levels. Annual data masks the larger degree of variability which occurs within a calendar year and increases the difficulty of obtaining accurate inventories.

TABLE 25. PRECIPITATION DATA FOR NORTH DAKOTA FOR 1931 TO 1980

Year	Northeast	North Central[1]	Central	East Central	Southeast	Devils Lake
1931						18.51
1932						20.02
1933						10.91
1934						11.78
1935						19.52
1936						10.29
1937						14.79
1938						15.55
1939						14.66
1940						23.17
1941						25.37
1942						18.30
1943						13.43
1944						25.26
1945						19.57
1946						13.67
1947						16.39
1948						15.70
1949						15.48
1950						17.85
1951						13.40
1952						10.83
1953						17.63
1954						22.37
1955						19.29
1956						21.16
1957	21.05	15.37	20.93	24.36	23.89	
1958	14.04	12.09	14.13	17.66	16.96	
1959	19.15	16.88	15.51	18.38	17.57	
1960	15.23	13.62	16.99	18.81	20.11	
1961	14.88	11.15	13.68	18.27	16.93	
1962	19.99	17.72	22.34	23.91	28.87	
1963	15.65	17.42	14.43	14.30	18.65	
1964	22.39	20.06	21.05	21.88	20.43	
1965	22.54	19.72	20.81	25.92	23.10	
1966	19.68	14.32	17.18	19.67	19.77	
1967	14.03	13.11	13.72	14.56	17.13	
1968	21.19	20.00	19.31	22.39	23.17	
1969	15.61	15.58	16.88	20.74	18.12	
1970	20.14	18.69	16.25	19.88	17.56	
1971	19.97	20.61	18.76	22.47	21.59	
1972	15.53	16.08	15.22	18.99	17.38	
1973	18.34	18.20	16.34	19.82	18.06	
1974	18.72	16.69	16.52	20.69	11.72	
1975	17.65	23.21	19.92	19.68	25.06	
1976	13.48	11.86	11.36	10.87	9.78	
1977	21.57	17.58	20.88	28.12	26.92	
1978	16.47	15.29	16.20	17.30	20.78	
1979	17.02	13.75	16.19	18.77	17.09	
1980	19.09	21.43	20.37	16.36	16.22	

[1] Devils Lake falls within the North Central Region after 1956.

SOURCE: U.S. Department of Commerce. Climatological Data. North Dakota Annual Summary, 1931-1980.

The effect of long term precipitation changes is not as clear. Increases in flooding, river flows, and lake levels have been blamed on high precipitation rates in recent years, drainage of prairie potholes, and changes in farming practices which cause more runoff. A study by Brun _et al_. (1981) concluded that land drainage, not precipitation patterns account for increased flows of several rivers in eastern North Dakota. U.S. Corps of Engineers position is that drainage of wetlands has not been a significant cause of increased flows or flooding (LSRCC, 1979).

Rainfall in the Devils Lake basin does not exhibit any major variation among decades (Table 26).[12] There is approximately one half inch difference in annual precipitation rates between the period 1931 to 1960 and 1961 to 1980. This does not appear to be a large enough difference to cause major changes in wetland trends based on visual interpretation of the data.

TABLE 26. AVERAGE ANNUAL RAINFALL PER DECADE IN DEVILS LAKE BASIN

Year	Precipitation
1931-40	15.92 inches
1941-50	18.10 inches
1951-60	15.64 inches
1961-70	17.72 inches
1971-80	17.01 inches

Attitudinal Factors

Wetlands have historically been a complex issue; on one hand they provided early settlers with furbearing animals, waterfowl, and game animals, and on the other, they were considered a hindrance to agriculture and other types of economic development. The Swamp Land Acts of 1849, 1850, and 1860 granted 64,895,415 acres to the states for reclamation, i.e., drainage (Shaw and Fredine, 1956). The states, in turn, sold, bartered, and transferred wetlands to private ownership. Federal and state legislation also provided for the organization of drainage districts.

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[12] Devils Lake falls within the North Central region after 1956 and provides the longest time span of precipitation data.

Drainage of wetlands was a patriotic duty during WWI and WWII to increase food supplies. U.S. Department of Agriculture, via ASCS, provided cost sharing, about 50 percent, for drainage activity until 1977. These governmental programs reflected general attitudes within the agricultural sector during that time. Official policies did not change until 1958 when PL85-585 amended the Duck Stamp Act to allow purchase and lease of wetlands.

Landowner attitudes were assessed in two recent studies (Leitch and Danielson, 1979; Smutko, 1982). The Minnesota study was based on personal interviews with 137 farm operators in Douglas, Grant, and Otter Tail counties. A mail survey of 528 farm operators, 151 responding, in Mountrail, Ramsey, and Sargent counties provided the data for the North Dakota study.

A set of 14 statements was used to assess general attitudes toward wetland perservation in both studies (Table 27). A higher percentage of respondents in Minnesota, 30 percent, than in North Dakota, 23 percent, favored

TABLE 27. ATTITUDE OF FARM OPERATORS TOWARD WETLAND PRESERVATION AND DRAINAGE

	Minnesota	North Dakota
	---number---	
Propreservation	41	24
Neutral	46	39
Prodrainage	50	41
Total	137	104

SOURCES: Leitch and Danielson, 1979. Smutko, 1982.

preservation of wetlands. More than one-third of the respondants in both studies were rated as prodrainage of wetlands. Analysis of the relationship among respondants' attitude and other characteristics revealed few statistically significant relationships. The number of years in farming and specialization in crop production were both positively related to a prodrainage attitude in North Dakota. Several factors were significantly related to attitudes in Minnesota (Table 28). Dairy farmers with farming as their primary occupation and plans to expand cropland were prodrainage. Weed problems with wetlands and refusal to participate in preservation programs were also related to prodrainage attitudes. Hunters, beef and hog producers, and participants in preservation programs favored preservation of wetlands.

TABLE 28. SUMMARY OF FACTORS ASSOCIATED WITH ATTITUDES TOWARD WETLANDS IN MINNESOTA

Prodrainage	Propreservation
1. Expand crop acreage	1. Hunters
2. Plan to drain	2. Beef and hog producers
3. Favor government aid for drainage	3. Participants in preservation prgrams
4. Prior problems with preserved wetlands	
5. Dairy farmers	
6. Price refusal to participate in preservation programs	
6. Farming as primary occupation and plans to remain in farming	

SOURCE: Leitch and Danielson, 1979.

Provision of wildlife habitat was the most frequently mentioned reason by farm operators supportive of wetlands preservation (Table 29). Water conservation, including groundwater recharge and flood prevention was also mentioned as a positive aspect of wetlands. Landscape diversity, and natural condition were also given as reasons for maintaining wetlands.

TABLE 29. REASONS GIVEN FOR BEING SUPPORTIVE OR NOT SUPPORTIVE OF WETLANDS PRESERVATION

	Minnesota	North Dakota
	-----------number-----------	
Supportive Respondants		
1. Provide wildlife (habitat)	35	123
2. Water conservation	11	92
3. Natural condition	10	118
4. Place to hunt	6	110
5. Prevent flooding	3	121
6. Landscaping diversity	3	
7. Source of hay		100
Not Supportive Respondants		
1. Nuisance	8	106
2. Weed problems		111
3. Dislike government controls	7	--
4. Reduce cropland	4	91
5. Sufficient supply of wetlands	3	--
6. Create flooding	--	48
7. Attract harmful wildlife	--	59

Most of the reasons for nonsupport of wetland preservation involved a type of irritation or cost to agriculture. Nuisance, weed problems, harmful wildlife, flooding, and cropland reduction individually were minor reasons for drainage of wetlands, however, they are additive to a major extent. These reasons are consistent with responses to another question on reasons for drainage. Increased cropland and better use of the field were the major reasons.

Farm operators who had refused to participate in government preservation programs were asked their reasons for refusal (Table 30). Low payment and length of the contract period were mentioned most frequently by the respondents. A second category which was mentioned often pertained to restrictions in the contract limiting the operator's future use of the land. Weed control by U.S. Fish and Wildlife Service was also a major problem. Lack of information about the programs was a reason for refusing USFWS contracts in

TABLE 30. REASONS FOR REFUSAL TO PARTICIPATE IN FEDERAL PRESERVATION PROGRAMS[1]

	Minnesota		North Dakota		
	FWS Easement	FWS Purchase	FWS Easement	FWS Purchase	USDA Water Bank
	number of responses				
Perpetual lease	3	--	19	--	--
Payment too low	3	2	40	25	39
Trespass problems	2	--	--	27	--
Contract restrictions	1	--	34	--	--
Lack of information	--	--	24	28	--
Too much upland required	--	--	--	29	35
No grazina or haying	--	--	--	27	34
Lack of FWS weed control	--	--	--	40	--
Contract period too long	--	--	--	--	35

[1] Minnesota study of 137 respondents, 151 respondents in North Dakota.

SOURCES: Leitch and Danielson, 1979. Smutko, 1982.

North Dakota. This would appear to be one of the easier objections to remove by means of a more active information program.

Improvement of wetland preservation programs involved several factors according to the respondants from these two studies (Table 31). The improvement suggestions were consistent with reasons for refusing contracts. More

TABLE 31. SUGGESTIONS TO MAKE WETLANDS PRESERVATION PROGRAMS MORE ATTRACTIVE TO LANDOWNERS

	Minnesota		North Dakota	
	All Programs	Easement	Purchase	Water Bank
More information	29%	89%	64%	--%
Higher payments	19	95	--	47
Shorter leases	17	90	--	78
Fewer restrictions	14	86	--	--
Purchase only wet area	8	--	--	--
Dismissal upon transfer of Ownership	--	96	--	--
Right to graze and hay	--	--	--	86

SOURCES: Leitch and Danielson, 1979. Smutko, 1982.

information, higher payments and shorter contract periods were the major adjustments preferred by landowners.

Major farm organizations reflect views similar to those identified in the two attitudinal studies. They are not opposed to wetland preservation as long as the individual farmer does not have to bear the financial burden alone. Short term agreements with financial compensation equal to the net income foregone are favored by the organizations. They are not supportive of purchase or perpetual easement programs (League of Women Voters, 1980).

Legal and Institutional Factors

Most prevalent legal and institutional factors affecting wetlands are federal and state laws and programs. Some programs encourage drainage while others discourage or prohibit activities which destroy wetlands. This section discusses the laws, regulations, and programs which influence wetlands. Major focus is on overlap, gaps, and contradictions among the programs both as they were envisioned when established and as they are being implemented.

Each subsection addresses one federal or state law or program. A description of actual implementation and comments[13] by knowledgeable persons for each program is presented. In addition, subsections discussing state programs contain brief descriptions of the intent of the program.

Federal Programs

Corps of Engineers' 404 Program

The United States Army Corps of Engineers administers two programs with jurisdiction over waters in the three state study area. One program is

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[13] See Appendix B for specific comments by respondents. Not all comments are legally correct but do represent what respondents believe the law to be which can be more important in implementation of a program than actual wording of the statute or regulation.

Section 10 of the River and Harbor Act (30 Stat. 1151; 33 USC 403) which requires Corps permit before any structure, dam, dike, or work may be placed in navigable waters of the United States. Few prairie potholes are described by the definition of navigable waters of the United States. This leaves Section 10 with little application to prairie potholes.

The second program is Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (33 USC 1344) which requires a Corps permit to discharge dredge or fill material into waters of the United States. Waters of the United States is more encompassing than navigable waters of the United States. It means all waters including wetlands and prairie potholes (33 CRF Part 323.2).

To ease the administrative burden of processing applications for permits for activities which most likely will be granted a permit, the Corps is authorized by statute to grant nationwide and general permits. One nationwide permit (33 CFR Part 323.4-2) allows discharge of fill or dredged material into lakes and adjacent wetlands if the area is less than 10 acres and is either (1) isolated, or (2) above headwaters. This permit also allows discharge into waters not part of a tributary system to interstate or navigable waters. Due to the small size and isolated nature of many prairie potholes, the nationwide permit excludes many prairie potholes from the Corps jurisdiction. Only 8 percent of wetlands in Douglas County, Minnesota, were within the Corps jurisdiction (Berry, 1981). The remainder were exempt under the nationwide permit.

The breadth of the Corps effective jurisdiction is also substantially less because it regulates only discharge of fill or dredged material. The Corps does not have regulatory authority over drainage activity which does not place dredged material back into the wetland. As a result, landowners can legally drain wetlands, if they do not discharge any of the dredged material into the wetland.

Enforcement is another problematic aspect of 404. The Corps must rely on other agencies to detect and report violations. In Minnesota, there are six regional hydrologists and their staffs, one or more game wardens per county, and private citizens to aid in detection of Section 404 violations. It is believed by some that most complaints by private citizens arise from disagreements between neighbors with one party intending to "get even with" the other by reporting illegal drainage. Minnesota Department of Natural Resources (DNR) also assists by sending the Corps a copy of each application received by DNR. DNR provides this information in response to a request from the Corps to be notified of all applications. The Corps decides whether the activity is regulated by 404.

North Dakota agencies do not inform the Corps of activities it may have jurisdiction over even though they are not prohibited from doing so. Other agencies which inform the Corps of possible violations include Environmental Protection Agency, U.S. Fish and Wildlife Service, and other state and federal agencies. The Soil Conservation Service is one of the agencies which receives from the Corps notice of applications for 404 permits. However, SCS seldom comments on applications explaining that it often has "no comment" if allowed an opportunity to review a project early.

In enforcing the 404 program the Corps most often uses civil actions, injunctions, and attempts to force restoration. Authority to impose administrative penalties for violations of the act in addition to penalties for violations of permits would, according to the Corps, enhance enforcement of 404. Without this authority, the Corps has no penalty to levy administratively on persons discharging without a permit; instead the Corps must follow more involved, time-consuming procedures.[14]

In the twelve month period from June 1981 through May 1982, the Corps of Engineers, St. Paul District, took action on 77 permits and 11 violations of 404 involving wetlands in eastern North Dakota and Minnesota (Table 32). Similar data for the remainder of North Dakota and South Dakota has been received from the Omaha District (Table 33). Comments about 404 ranged from "ineffective against changes in wetlands" to "it does an acceptable job."[15] Reasons for describing it as ineffective include: 1) applies only to fill; 2) lacks enforcement and must rely on other agencies to report violations; 3) nationwide permit removes nearly all wetlands from 404; 4) 404 definition of wetlands does not include wetland types 1 and 2; and 5) after-the-fact permits are too easily obtained. The primary positive attribute mentioned is that 404 furnishes a helpful back-up for state regulatory programs.

Suggestions for changes in the law were: 1) add drainage activities to 404 jurisdiction, 2) establish a clearer line of authority including more definite jurisdictional lines,[16] 3) provide for swifter penalties, and 4) categorize nationwide permit according to activity rather than affected water body.

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[14] Study of 404 enforcement is currently being conducted by the Institute of Water Resources. Personnel at St. Paul District, Corps of Engineers are involved in this effort.

[15] For specific comments by respondents, see Appendix B.

[16] Two jurisdictional definitions that could be clarified are (1) distinction between 402 and 404, and (2) whether the act of dredging is regulated by 404.

TABLE 32. SECTION 404 PERMIT ACTIONS AND VIOLATIONS FOR MINNESOTA AND EASTERN NORTH DAKOTA, MAY 1981 TO APRIL 1982

	Minnesota	North Dakota	Total
Permit actions involving wetlands			
Applications prior to activity			
Approved	37	3	40
Approved in part and denied in part	2		2
Denied[b]	6	1	7
Withdrawn	3	1	4
No jurisdiction or nationwide permit	10	1	11
Denied and restoration ordered[b]	5		5
Total	63	6	69
After-the-fact permits			
Approved	3		3
Approved in part and denied with restoration in part	1		1
Denied[b]	2		2
Denied with restoration[b]	1		1
No jurisdiction	1		1
Total	8		8
Total Wetland permit actions	71	6	77
All other 404 & Section 10 permit actions[a]	292	12	304
Total permit actions	363	18	381
Violations involving wetlands			
Nationwide permit	2		2
Application being processed	4	2	6
restoration	1	1	2
Action not indicated	1		1
Total wetland violations	8	3	11
All other 404 & Section 10 violations	31	0	31
Total violations	39	3	42

[a] These actions did not involve wetlands

[b] Usual reason permit is denied is the activity did not meet either Environmental Protection Agency guidelines or the Corps public interest standard which includes the water-dependency test.

SOURCE: U.S. Army Corps of Engineers, Notice of Permit Actions, St. Paul, Minnesota, May 1981 to April 1982.

TABLE 33. SECTION 404 PERMIT ACTIONS AND VIOLATIONS FOR SOUTH DAKOTA AND ALL BUT EASTERN NORTH DAKOTA, MAY 1981 TO APRIL 1982[a]

	South Dakota		North Dakota		Minnesota	
Permit actions involving wetlands						
Applications prior to activity						
Approved	2		3		5	
Nationwide or general permit	2		3		5	
Total		4		6		10
After-the-fact permit						
Approved	1		0		1	
Total		1		0		1
Total wetland permit actions		5		6		11

[a] This table contains information comparable to Table 32. Information about violations or permits not affecting wetlands was not requested.

SOURCE: U.S. Army Corps of Engineers, Omaha, Nebraska, July 1982.

Comments about present operation were: 1) processing of applications takes too long especially if Corps exercises its discretionary authority,[17] 2) proposed regulations are a step backwards because discretionary authority is moving up the hierarchy, and 4) applicants apply for permits to fill more than they want or need and thus establish themselves in a better bargaining position.

United States Department of Agriculture Water Bank Program

Under this program, owners of wetlands enter into an agreement with the Agricultural Stabilization and Conservation Service (ASCS) promising not to drain, burn, fill, destroy, nor use wetlands for 10 years in exchange for an annual payment. Fifteen states participate in Water Bank. Minnesota, North

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[17] The Corps has discretionary authority to require an individual permit even though the activity is allowed by a nationwide or general permit (33 CFR Part 323.4-4). Discretionary authority is seldom exercised.

Dakota, and South Dakota are the major participants, accounting for more than two-thirds of the program's contract acreage.

Not all counties in the three states are eligible. In Minnesota, 36 of 87 counties are eligible while 30 of North Dakota's 53 counties and 42 of South Dakota's 67 counties are eligible. Technical information about individual wetlands is provided by Soil Conservation Service (SCS) to the county ASCS committee for final decision whether to designate an area for participation in Water Bank.

Wetlands as well as adjacent uplands are designated. About one-fourth of water bank acreage is wetlands with the remainder consisting of upland acreage determined to be beneficial wildlife habitat.

Payment rates vary according to the classification of the land, its rental value and its market value. Annual rates for wetlands range from $7.00 to $12.00 per acre.[18] If the wetland is also under easement to U.S. Fish and Wildlife Service or a state game and fish department, the rate is two dollars less per acre. It is well-known that simultaneous participation in both programs is admissible but no state has kept actual records of how many do participate in more than one preservation program. State ASCS officers are not concerned about the duplication because Water Bank protection is more encompassing than U.S. Fish and Wildlife easements. The additional protection results from inclusion of adjacent wetland and prohibition of agricultural uses of wetland area even during dry years. State ASCS does have authority to allow haying and grazing of Water Bank property during dry years but North Dakota has not done so in the past. South Dakota, on the other hand, has allowed grazing and haying during droughts and feels the habitat area was improved as a result.

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[18] Annual rates for Federal Water Bank program are: $10 in Minnesota if not under USFWS easement; $7 to $12 in North Dakota if not under USFWS easement; and $10 in South Dakota if not under USFWS easement.

The first 10-year Water Bank agreements were initiated in 1972. As these have expired, some landowners have re-entered the program. The number of new participants and new wetlands has decreased each year for the past several years. Despite these decreases in numbers, the states have been successful to the extent that they have expended nearly all their Water Bank funds each year. In some years, these three states were appropriated additional funds in order to meet the many requests for participation. At times, applicants have had to delay their participation one or two years until more funds came available.

The number of agreements for 1981 dropped significantly from prior years and projections for 1982 are similar to 1981. Personnel at North Dakota state ASCS office explained the situation. Number of applications during 1981 were lower due to poor crops the previous two years which caused landowners to use even marginal agricultural land to make up for lost production rather than placing the areas into the Water Bank program.

The number of applications during 1982 are higher again but due to funding levels, only about a third will become part of the program. Remainder of 1982 appropriations is being used to renew expired agreements as well as update payment rates. Projections for 1983 are that fewer new agreements will be funded as again most of the appropriations will be needed to renew the large number of expiring agreements.

Acreages of participating wetlands and uplands are presented in Tables 34 and 35. It is not clear what percent of the column entitled Designated Acres--Wetlands refers to wetland types 3, 4, and 5. There is a requirement that each Water Bank unit must contain an area of type 3, 4, or 5 wetland, but can also include other wetlands.

The following comments apply to all state and federal water bank programs in the study area. Nearly every respondent agreed that water bank is

TABLE 34. NUMBER OF AGREEMENTS, ACRES, AND SIZE OF ANNUAL PAYMENTS UNDER USDA WATER BANK PROGRAM AS OF SEPTEMBER 30, 1981

	Number of Agreements	Designated Acres			Annual Payment ($)
		Total	Wetlands	Adjacent	
Minnesota	1,639	85,861	22,032	63,829	1,846,194
North Dakota	1,768	248,690	69,943	178,747	3,699,864
South Dakota	1,024	148,479	30,765	117,714	2,258,341
Three States Total	4,431	483,030	122,740	360,290	7,804,399
All Other States	1,706	183,384	62,630	120,754	2,221,214
National Total	6,137	666,414	185,370	481,044	10,025,613
Three State Total as a Percent of National Total	72.70	72.48	66.21	74.89	77.84

SOURCE: Adapted from United States Department of Agriculture, "Water Bank Program, 1972 Through September 30, 1981," ASCS, Washington, May 1982.

a good program having positive effects on wetlands. Acquisition of uplands to form a buffer around the wetland, elimination of the "taking" question and provision of an economic alternative to drainage were identified as strong points. One suggestion was to continue Water Bank in conjunction with the permanent acquisition program. One official felt that compensatory programs such as Water Bank are bad precedent. It was suggested that rural areas, including wetlands, be regulated under the same social and legal principals zoning uses to regulate urban areas. Views on present implementation were: running out of funding, should consider the trade-off between permanent easements and annual lease, effectiveness varies according to area and land prices, does not prevent later drainage, participating land would not have been drained anyway, and there are very few violations and most of them are unintentional.

United States Department of Agriculture Cost-Share of Drainage

Between 1940 and 1977, the United States Department of Agriculture (USDA) was authorized to assist landowners in draining their wetlands by

TABLE 35. STATUS OF AGREEMENTS CARRIED OUT UNDER THE WATER BANK PROGRAM, 1972 THROUGH SEPTEMBER 30, 1981, BY STATE

Program Year	Number of Agreements	Designated Acres			Annual Payment ($)
		Total	Wetlands	Adjacent	
Minnesota					
1972	197	8,299	2,086	6,213	180,746
1973	61	3,909	1,036	2,873	92,314
1974	308	16,050	4,616	11,434	345,495
1975	134	6,947	1,977	4,970	143,653
1976	99	6,432	1,655	4,777	133,042
1977	164	10,967	2,680	8,287	267,669
1978	199	11,934	2,453	9,481	213,294
1979	261	9,747	2,321	7,426	210,333
1980	153	9,050	2,460	6,590	204,417
1981	42	1,670	479	1,191	35,379
1982[a]	21	856	269	587	19,852
Total	1,639	85,861	22,032	63,829	1,846,194
North Dakota					
1972	27	2,381	732	1,649	60,630
1973	212	21,993	7,344	14,649	392,785
1974	247	27,960	10,339	17,621	373,427
1975	283	38,139	11,766	26,373	449,701
1976	203	29,144	7,466	21,678	458,053
1977	249	45,074	10,700	34,374	780,275
1978	144	27,753	6,972	20,781	390,934
1979	222	33,024	8,311	24,713	445,112
1980	118	16,663	4,158	12,505	239,093
1981	51	5,291	1,712	3,579	85,862
1982[a]	12	1,268	443	825	23,992
Total	1,768	248,690	69,943	178,747	3,699,864
South Dakota					
1972	48	3,498	974	2,524	43,775
1973	108	15,384	3,503	11,881	224,269
1974	165	21,547	5,703	15,844	284,198
1975	79	11,803	2,987	8,816	157,150
1976	70	12,390	3,565	8,825	158,833
1977	151	31,165	5,063	26,102	481,224
1978	117	15,894	2,806	13,088	232,578
1979	110	15,896	2,226	13,670	312,223
1980	119	15,738	2,788	12,950	274,133
1981	51	4,618	1,053	3,565	82,861
1982[a]	6	546	97	449	7,097
Total	1,024	148,479	30,765	117,714	2,258,341

[a] The agreements were entered into in 1981. Since compliance could not be rendered during 1981, the agreements were given the beginning date of January 1, 1982.

SOURCE: USDA, "Water Bank Program, 1972 Through September 30, 1981," ASCS, Washington, May 1982.

providing both technical information and cost-share. Table 36 shows the number of acres served by ASCS cost-share for each year between 1942 and 1980 for Minnesota, North Dakota, and South Dakota. Minnesota's 40 year total of over 5 million acres is the highest of any state in the nation and represents nearly 9 percent of the total acres served by ASCS cost-share during the life of the program. Substantially fewer acres were served in North Dakota and South Dakota. There is no data indicating how much technical information about drainage was provided by SCS.

The numbers in the table may not describe all the implications of cost-sharing drainage. Public, as well as private, projects were assisted. It has been established that once a large public drain was constructed, private drainage of nearby land was accelerated (Erickson, 1975). If these private projects did not receive cost-share, their numbers would not be recorded in ASCS summaries. Thus, cost-share may have induced drainage of more than the 56 million acres of record. No one was willing to estimate the extent of induced drainage.

In 1962 Congress enacted a statute forbidding USDA from providing financial or technical assistance for wetland drainage in Minnesota, North Dakota, and South Dakota if the Secretary of Interior had found that wildlife preservation would be materially harmed by the drainage (16 USC S 590 p - 1). These findings are made on a farm-by-farm basis and continue for one year unless some government agency offered to purchase or lease the wetland. If such an offer was made but rejected by the landowner, the prohibition terminates five years after the Secretary of Interior's finding.

President Carter issued Executive Order 11990 (1977) requiring all federal agencies to minimize loss of all types of wetlands. As a result, ASCS cost-sharing decreased and terminated within a few years. Likewise, SCS

TABLE 36. ACRES SERVED BY ASCS DRAINAGE COST-SHARE PROGRAM IN THREE STATES BETWEEN 1940 AND 1980

Year	Minnesota	North Dakota	South Dakota
1942	490	0	0
1943	45,600	47,397	0
1944	234,670	34,016	14,190
1945	210,840	108,828	35,210
1946	380,692	104,685	47,935
1947	725,650	246,360	165,820
1948	0	95,573	87,395
1949	263,690	145,215	88,470
1950	192,859	120,921	117,415
1951	161,554	60,353	54,465
1952	138,313	105,088	60,552
1953	172,683	98,969	42,677
1954	82,360	87,780	26,769
1955	188,731	64,342	10,658
1956	113,413	39,372	2,967
1957	91,158	23,918	5,675
1958	239,988	42,673	4,990
1959	138,855	22,467	1,560
1960	168,655	25,460	2,859
1961	129,543	13,683	2,188
1962	111,201	16,541	1,932
1963	137,421	14,138	1,541
1964	116,488	17,689	583
1965	99,885	10,227	728
1966	106,153	8,704	285
1967	193,824	24,882	312
1968	62,316	26,017	0
1969	102,601	31,045	0
1970	94,239	34,069	0
1971	50,874	13,008	0
1972	91,653	17,401	0
1973	73,591	25,541	0
1974	0	0	0
1975	34,870	30,102	108
1976	21,273	8,933	95
1977	14,314	7,110	301
1978	8,259	4,940	321
1979	4,577	3,694	25
1980	262	40	0
Total	5,008,544	1,781,181	778,031

Total Number of Acres Drained in the Nation by These Programs Between 1940 and 1980: 56,911,277.

SOURCE: U.S. Department of Agriculture, "Agricultural Conservation Program, 45-Year Statistical Summary, 1936 Through 1980," ASCS, 1981.

employees are officially limited in the technical information they may provide about wetland drainage (7 CFR Part 650.26). Regulatory changes have been proposed that would allow SCS to assist not only in altering and converting Type 1 and 2 wetlands but also draining them (Federal Register, Vol. 46, No. 206, October 26, 1981, 52119). Also proposed is replacing the ban on assisting alterations of Types 3 through 20 wetlands with a provision allowing assistance in making minor alterations which will provide habitat values equal to or greater than those lost.

Changes in ASCS programs are easily monitored and controlled through appropriations. However, monitoring provision of technical information is not as easy and there are incidents where such information has been provided since 1977. Local SCS personnel may find it difficult not to provide information to their neighbors. When private drainage occurs, information by SCS may improve the efficiency of drainage. In addition, if SCS designs the drain, there is an opportunity that the constructed drain will affect only part of the wetlands while preserving the remainder. Technical information could aid in protecting wetlands in this way. Regardless of stated policy, however, it will continue to be difficult to effectively control distribution of technical information about drainage.

Comments about USDA sharing the cost of drainage and elimination of those programs varied from being a substantial factor in preserving wetlands to that it made no difference. Those feeling that the impact was substantial cited the subsidy, stating that its elimination has to have an impact. Others felt federal and state government still support drainage if by no other means than by attitude. No one felt Executive Order 11990 was a significant factor affecting drainage.

Federal Income Taxes

Federal income tax law allows landowners to deduct as business expense costs incurred in draining land. This reduction in taxes is in direct conflict with attempts (especially economic incentives) to encourage landowners to preserve wetlands.

Drainage costs can result in reduced taxes in several ways. Some drainage costs qualify for investment credit (tile drainage) as well as depreciation during the useful life of the drain. Other costs may be completely deducted the year in which the expense is incurred if the legal requirements are met (Internal Revenue Code, Sections 175 and 182). This method produces the greatest tax savings. Finally, drainage costs can increase the basis of the drained land for capital gains calculations. This method produces the least tax savings since none is realized until the property is sold. It was the small tax savings of this method that led to enactment of tax laws more beneficial to landowners who drain.[19]

One study (Leitch and Kerestes) found the tax savings due to deducting drainage expenses were offset by higher taxes due to income earned from the drained property. However, if landowners greatly discount any increased future tax liability, income taxes can still encourage drainage. The only comment was that the deduction definitely decreases drainage cost. One person recommended elimination of deduction, investment tax credits, and any other income tax savings resulting from drainage activities.

United States Fish and Wildlife Service Purchase and Easements

The U.S. Fish and Wildlife Service acquires property through purchases and easements in all three states under the Small Wetlands Acquisition Program.

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[19] House of Representatives, Internal Revenue Code of 1954, Report of Committee on Ways and Means, Report No. 1337, 83rd Congress, 2d Session, 1954, page 29.

Table 37 indicates the number of acres controlled by U.S. Fish and Wildlife Service.

TABLE 37. LANDS UNDER CONTROL OF U.S. FISH AND WILDLIFE SERVICE AS OF SEPTEMBER 1981

States	National Wildlife Refuges	Waterfowl Production Areas[a]	
		Total[b]	Easement
	(acres)		
Minnesota	193,827	161,787	36,415
North Dakota	271,674	986,821	769,000
South Dakota	43,453	424,377	303,000

[a] Do not know what portion of these acreages are deep water lakes; 100 percent of easements and an estimated 30-40 percent of refuges and owned production areas are wetlands.

[b] The difference between total and easement is presumed to be owned fee simple.

SOURCE: U.S. Department of Interior, "Annual Report of Lands Under Control of U.S. Fish and Wildlife Service."

Recent acquisitions in South Dakota average 19,000 acres annually of which over 17,000 acres are protected by easement. Purchases in Minnesota have been less ranging from 3,700 to 200 acres for the years 1978 to 1981, inclusive. Acquisitions in Minnesota were lower due to higher land values, greater importance of row crops, tradition of draining, and topography.

Acquisitions in North Dakota have been stopped since 1979 when the state legislature enacted a statute that all future acquisitions must count as mitigation acreage for the Garrison Diversion project. U.S. Fish and Wildlife Service disagreed and federal courts have held the North Dakota statute unconstitutional. Subsequently, North Dakota enacted another statute prohibiting the Governor from approving any U.S. Fish and Wildlife Service acquisitions until a mitigation plan is established or December 31, 1983, whichever comes first. Until one of those occurs, no acquisitions will be made in North Dakota. The statutes differ in that the first one attempted to direct the actions of a federal agency whereas the latter one directs the activities of the state's executor. This distinction may be sufficient to allow the latter one to withstand constitutional challenges.

Comments about U.S. Fish and Wildlife Service acquisitions are that it is an effective means and a significant factor in the preservation of wetlands, the acquisition program provides an economic alternative for wetlands and prevents later owners from draining. Easements are considered better than short term leases. Purchases are considered better than easements; easements may cause resentment in later years as well as be more difficult to enforce due to local pressure. North Dakota has experienced drainage on easement land, but violations have been less than 1 percent annually. Other comments were that the land would not have been drained anyway, acquisitions are too concentrated and effectiveness varies with area, land prices, and funding level.

State Programs

State programs (or the lack of them) have an influence on drainage or preservation of wetlands. Select programs from each of the three states will be described. Second, impacts of the programs will be discerned by number or acres of wetlands affected by each program. Finally, comments of persons familiar with the program and their impacts will be presented.

Minnesota

Protected Waters and Water Bank

Minnesotans, like people in other states, historically viewed wetlands as an inconvenience. First statutes addressing the topic were intended to facilitate drainage and resolution of problems arising from drainage. However, during the late Sixties and Seventies, Minnesota statutes changed to preservation of wetlands. This change is attributed by some to the increasing influence of the Twin Cities metropolitan area in the State legislature.

The statutory scheme is to preserve certain water bodies by declaring them to be of such value to the public that they should be preserved rather than drained. This process has encountered two problems. The first problem is the difficulty of defining and identifying which bodies of water are of public value and should not be drained. The second problem is whether a prohibition against drainage amounts to a taking of private property for public benefit. If it is a taking, the prohibitive regulation would be unconstitutional due to lack of just compensation.

Public waters definition was first extended to include selected wetlands in 1973. Wetlands must function as nutrient and sediment retention, storm water storage, fish and wildlife habitat, recreation, or ground water recharge in order to be a public water. Department of Natural Resources (DNR) was authorized to identify wetlands serving material beneficial public purpose by completing an inventory of wetlands in the state. The statutory process of declaring a water body public water included an opportunity for local government officials to review and protest any proposed declaration. Protests were to be resolved through negotiation and, if unsuccessful, a contested case hearing.[20]

Due to several problems, including lack of local cooperation, the 1973 inventory/declaration process was never completed. Instead, the 1979 legislature ordered a new inventory, declaring protected waters (renamed from public waters) included wetland types 3, 4, and 5. The second inventory process is thus an effort to identify the three protected types of wetlands in the state. Again the inventory process includes an opportunity for local government officials to protest a determination that a wetland is type 3, 4, or 5. The preliminary inventory process is nearing completion with review by local officials and hearings, if necessary, during summer and fall, 1982. This inventory includes wetland types 3, 4, and 5 greater than 10 acres in unincorporated areas, and greater than 2-1/2 acres in incorporated areas as protected waters. All other types of wetlands are excluded from the inventory.

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[20] William Mitchell Law Review, William Mitchell College of Law, St. Paul, Minnesota, Vol. 6, No. 1, p. 149; citing Office of Legislative Auditor, Evaluation Report on Water Resources Management 12 (December 1978).

In 1973, Minnesota Supreme Court overruled[21] a lower court decision which prohibited drainage of a wetland in order to preserve it for the public benefit. In its reasoning, the Supreme Court discussed a state statute which required landowners to be compensated, and without compensation the drainage project could not be prohibited. The court did not (and had no reason to) decide whether prohibition of drainage was a proper exercise of police power and one can only speculate as to the purpose the legislature may have had when it enacted the statute. The State Legislature, in 1976, implemented a Water Bank program which allowed owners of wetlands to be compensated if any application to drain was denied. This avoids the taking question.

These two programs (Protected Waters and Water Bank) are closely related. The only wetlands which qualify for Minnesota Water Bank are the three protected types--3, 4, and 5. Any application to drain a protected wetland will be automatically denied. The landowner will be able to drain legally if within 60 days DNR fails to offer some type of compensation. Without this offer, Minnesota case law would declare the rejection an illegal taking because the owner was not justly compensated. Acceptable offers, according to the statute, include State Water Bank, purchase, or indemnification by other means such as conservation restrictions, easements, leases, or any applicable federal program. To qualify for the Water Bank program, wetlands must also be of such a nature that drainage would be lawful, feasible, and practical; and that drainage would provide high quality cropland and that is its projected use. Wetlands less than 10 acres of types 3, 4, or 5 are not protected waters but can be admitted to the water bank program with the approval of the commissioner of DNR.

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[21] Schwermann v. Reinhart, 210 NW2d 33 (1973).

The landowner and DNR enter into 10-year renewable Water Bank agreements in which the owner agrees not to drain, burn, fill, destroy the wetland, nor use it for agriculture. In exchange, DNR makes annual payments equal to 5 percent of fair market value of land if drained minus drainage costs. In addition, the owner receives 5 percent of present fair market value for adjacent upland included in the program. First payments under this program were made in 1981 with annual payments ranging from $85 to $125 per acre.[22] Presently, 632 acres are involved in the Minnesota Water Bank program (Table 38).

An owner forfeits all future payments and may be required to refund past payments as a penalty for violating the agreement. Upon sale of a wetland subject to an agreement, the new owner may continue the old agreement, enter into a new agreement for 10 years, or not participate.

An application to drain protected wetlands will no longer be automatically rejected beginning ten years after the wetland had been designated protected. This essentially places a 10-year moratorium on drainage of wetland types 3, 4, and 5 in Minnesota. After the 10 years, permits to drain these types of wetlands will be issued if economic or other benefits accruing to the owner as a result of drainage outweigh the public benefit of having the wetland maintained.

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[22] Minnesota Department of Natural Resources, Personal Communication, St. Paul, Minnesota, June 1982.

TABLE 38. MINNESOTA STATE WATER BANK PROGRAM[a], SUMMARY THROUGH MARCH 31, 1982

Completed projects	28
Projects being appraised	24
Other	16
Applications not complete	1
Offers made, no response	7
Eligible, but no financial offer made	2
Ineligible--soils	2
Ineligible--legal prohibition	1
Ineligible--PWI process declared area protected	1
Wetlands deregulated	4
Total	70

Type	#	Acres	Total Cost	Annual Cost	Actually Paid	Remaining Cost
Completed Projects						
Purchase	5	239.19	253,008.00	244,508.00	244,508.00	8,500.00
Easement	1	49	19,975.00	19,975.00	19,197.00	0
Cons. Res.	1	102.2	48,789.48	12,197.37	12,197.37	36,592.11
Agreement	20	632.05	511,367.50	51,136.75	53,906.75	457,460.75
Lease	1	16.75	502.50	502.50	502.50	0
	28	1,039.19	833,642.48	328,319.62	311,089.62	502,552.86

Recording Fees, etc. = $1,142.02

Expended = $332,231.64

Projected Projects (Being Appraised)						
Purchase	6	337.1	418,441.25	418.441.25		
Easement	1	40	19,200.00	19,200.00		
Cons. Res.	1	20	11,200.00	11,200.00		
Agreement	15	413.35	361,300.00	36,130.00		325,170.00
Lease	1	60.5	1,851.30	925.65		925.65
	24	870.95	811,992.55	485,896.90		326,095.65

[a] Includes all means of indemnification rather than just water bank agreements.

SOURCE: Minnesota Department of Natural Resources, June 1982.

Comments about Minnesota Water Bank are also included in the comment paragraph under Federal Water Bank Program. Most officials felt Minnesota's drainage law was too narrow to be effective. It will probably work fine for type 3, 4, and 5 wetlands but leaves the others unprotected including small type 3, 4, and 5 wetlands. It was suggested that local political pressure will prevent any broadening of jursidiction. Presently there are fewer drain permit applications due to the economy but old drains are being repaired and, in some cases, deepened. The Corps feels the state regulates the easy ones, leaving them to handle the more difficult questions.

Habitat Acquisition Program

Department of Natural Resources is responsible under the Wildlife Lands Acquisition Program for acquiring Wildlife Management Areas. Fee purchases account for nearly all acquisitions which total 515,000 acres. Approximately 40 to 50 percent of this acreage is wetlands which are top priority when selecting areas to be acquired. Acquisitions during recent years averaged about 3,000 acres annually, but depends on the cost of land being acquired.

Funding is derived from a surcharge on small game hunting licenses. For 1982, the surcharge is $4, up from $2 in 1981. This should increase annual receipts to $1.2 million. The legislature also appropriated $2 million during the current biennium for Wildlife Management Area acquisitions. A total of $11 million has been appropriated since 1975 when the state embarked on a program entitled Resource 2000 with a goal of acquiring 1 million acres by the year 2000.

Purchases are made from willing sellers only. DNR, expecting U.S. Fish and Wildlife Service to reduce its acquisitions (see Table 39), does not intend to shift its emphasis away from wetlands. Table 39 shows the acreage acquired by U.S. Fish and Wildlife Service in Minnesota for recent years

TABLE 39. NUMBER OF ACRES ACQUIRED BY PURCHASE AND EASEMENT BY U.S. FISH AND WILDLIFE SERVICE IN MINNESOTA, YEARS 1978 TO 1981

Year	Total Acres Acquired[a]
1978	4,006
1979	2,320
1980	5,627
1981	2,119

[a] These numbers do not indicate a reduction but DNR expects U.S. Fish and Wildlife Service to reduce acquisitions.

SOURCE: United States Department of Interior, personal communication, Fish and Wildlife Service, St. Paul, Minnesota.

whereas Table 37 is the total acreage in Minnesota under U.S. Fish and Wildlife Service control as of September 1981.

The Minnesota Habitat Acquisition program is an important factor in wetlands preservation and coordinates well with U.S. Fish and Wildlife acquisitions.

Property Tax

As an added incentive for owners of wetlands to preserve the areas, Minnesota has a program that reduces property taxes of persons owning wetlands. Wetlands exempt from property taxation are defined in the tax statute as land mostly under water which produces little, if any, income; has no use except for wildlife or water conservation; is in its natural condition; drainage is feasible and practical and would result in land suitable for agriculture (except wild rice). Any adjacent land not suited for agriculture due to existing wetland is also exempt.

The exemption was first available during 1980 assessment (taxes payable in 1981). Exemption status was enacted after most 1980 assessments had been completed. To avoid conducting a second assessment, some assessors categorically exempted all wastelands. This means some rock piles as well as wetlands were not taxed. Some landowners requested that their wetlands not be identified or exempted so not to disclose or admit anything to DNR. These persons fear that by accepting exemption they are admitting the area is a wetland, and that DNR will know about the area and will prohibit drainage in the future.

Presently the exemption is on a year-by-year basis. The program provides annual incentive (through reduced taxes) for preserving wetlands but does not provide extended wetland protection; that is, landowners may drain wetlands in the following tax year.

The second part of Minnesota's tax program is a tax credit. Tax liability of contiguous upland is reduced by an amount equal to three-fourths of 1 percent of average market value of a tillable acre in the township for each acre of wetlands the taxpayer owns. This has nearly eliminated property tax liability for numerous landowners. However, excess credit is not refunded to the taxpayer. The credit is available to wetland owners in exchange for a promise not to drain during the year.[23] Tax credit is available even though the wetland is enrolled in the State or Federal Water Bank or under easement to the Fish and Wildlife Service.

The program provides for state reimbursement to counties for all revenue lost due to the exemption and credit program. If requests for reimbursements exceed the approximately $3.6 million appropriated for the program, each county will probably receive a proportionate share of the total (Table 40).

Comments about Minnesota property tax exemption/credit for wetlands ranged from effective to marginal at best. Responses included: there is a

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[23] Past promises have no binding effect during years when the landowner does not participate in the credit program.

TABLE 40. MINNESOTA WETLAND TAX PROGRAM, 1981

County[a]	Exempted Wetland Parcels	Exempted Wetland Acreage	Wetland Tax Credit (Dollars)	1979 Assessed Wetland Values	Amount of Reimbursement Due to Wetland Tax Program
Aitkin	0	0	0	0	0
Anoka	3,016	32,160	113,326	301,175	26,979
Becker[b]	1,343	5,668	14,742	37,224	2,900
Beltrami	330	7,103	9,233	47,244	4,623
Benton	1,035	15,151	61,546	176,996	15,139
Big Stone[b]	1,165	15,536	70,430	192,686	13,720
Blue Earth	147	2,120	18,753	31,800	2,120
Brown	44	720	7,486	4,320	249
Carlton	0	0	0	0	0
Carver	310	1,725	16,824	55,156	4,677
Cass	0	0	0	0	0
Chippewa	51	667	4,394	4,895	325
Chisago	1,475	20,959	103,100	647,617	60,456
Clay[b]	27	526	2,254	2,630	194
Clearwater	542	11,529	21,034	168,825	14,890
Cook	0	0	0	0	0
Cottonwood[b]	51	549	5,917	15,954	977
Crow Wing	0	0	0	0	0
Dakota	93	1,413	11,644	36,131	2,718
Dodge	0	0	0	0	0
Douglas[b]	791	10,887	43,067	147,850	10,258
Faribault	0	0	0	0	0
Fillmore	0	0	0	0	0
Freeborn	192	2,663	27,433	138,169	7,670
Goodhue	88	413	3,645	45,430	2,750
Grant[b]	644	10,064	46,249	264,304	15,590
Hennepin	0	0	0	0	0
Houston	0	0	0	0	0
Hubbard	2	68	47	340	32
Isanti	2,604	37,287	170,125	469,357	49,320
Itasca	0	0	0	0	0
Jackson[b]	18	456	4,541	15,960	837
Kanabec	3,455	2,431	8,270	120,873	13,408
Kandiyohi[b]	999	11,750	73,277	240,023	16,709
Kittson	16	220	625	4,679	365
Koochiching	0	0	0	0	0
Lac Qui Parle[b]	605	5,200	25,794	69,668	4,363
Lake	0	0	0	0	0
Lake of the Woods	290	9,875	20,676	498,885	49,004
LeSueur	679	6,937	59,154	75,125	6,123
Lincoln	307	2,110	8,765	32,118	2,046
Lyon	632	359	2,258	142,800	8,039
McLeod	112	1,461	12,885	21,332	1,516
Mahnomen[b]	1,540	12,342	34,462	221,903	21,362
Marshall	0	0	0	0	0
Martin	47	720	9,701	60,572	5,048

- continued -

TABLE 40. MINNESOTA WETLAND TAX PROGRAM, 1981 (CONTINUED)

County[a]	Exempted Wetland Parcels	Exempted Wetland Acreage	Wetland Tax Credit (Dollars)	1979 Assessed Wetland Values	Amount of Reimbursement Due to Wetland Tax Program
Meeker	572	6,653	48,810	49,907	3,362
Mille Lacs	2,279	39,572	149,876	214,032	24,721
Morrison	8,237	64,944	185,171	370	32,482
Mower	30	185	1,667	2,910	183
Murray	99	1,517	10,882	27,316	1,444
Nicollet	88	1,087	10,808	13,149	873
Nobles	35	592	5,256	9,819	599
Norman	508	5,226	16,719	52,092	3,734
Olmstead	0	0	0	0	0
Otter Tail[b]	9,802	87,376	198,521	655,049	48,599
Pennington	587	18,257	37,947	440,105	34,568
Pine	0	0	0	0	0
Pipestone	5	81	133	255	18
Polk[b]	1,007	22,164	53,712	1,193,797	95,922
Pope[b]	1,203	20,785	89,713	434,993	30,345
Ramsey	0	0	0	0	0
Red Lake	245	4,311	11,377	146,050	12,403
Redwood	27	259	2,427	15,239	800
Renville	2	67	546	11,864	601
Rice	933	8,329	68,900	191,697	14,371
Rock	0	0	0	0	0
Roseau	398	3,457	6,302	63,649	4,280
St. Louis	0	0	0	0	0
Scott	61	706	4,906	176,394	15,454
Sherburne	1,023	11,740	57,562	574,485	41,332
Sibley	107	1,437	14,897	28,797	1,689
Stearns[b]	110	1,863	7,477	9,315	692
Steele	211	2,236	15,025	55,222	3,191
Stevens[b]	262	4,943	29,559	170,285	11,355
Swift[b]	439	9,478	51,763	165,469	12,390
Todd	53	900	2,982	190	14
Traverse[b]	192	1,720	8,724	25,691	1,627
Wabasha	0	0	0	0	0
Wadena	8	189	434	526	48
Waseca	233	3,005	33,941	63,450	4,149
Washington	694	5,848	46,005	113,554	10,206
Watonwan	45	956	11,105	4,780	261
Wilkin[b]	112	1,304	6,139	21,312	1,291
Winona	0	0	0	0	0
Wright	1,732	17,555	97,058	454,460	34,911
Yellow Medicine[b]	19	335	1,657	21,164	1,256
TOTALS	54,139	584,184	2,307,246	9,758,506	816,227

[a] Some counties are not eligible for this program.
[b] Generally considered to be part of prairie pothole region.

SOURCE: Minnesota Department of Revenue, June 1982.

need for tighter definitions, it has not prevented drainage, implementation varies from county to county, wastelands are receiving wetland credit, and there should be a dollar limit on the amount of credit.

South Dakota

Drainage Law

Laws of South Dakota do not prohibit drainage nor require a permit to drain land. Landowners are free to drain without having to meet any statutory requirements. The only law addressing drainage was enacted in the early 1900s and like most drainage laws of that time, was intended to resolve problems among neighbors rather than preserve wetlands. The statute does not explicitly address either wetlands or private drainage. It specifies procedures to be followed in establishing a drainage district both when landowners agree and when they disagree about the proposed drainage project.

Acquisition Program

South Dakota's Game, Fish, and Parks Section administers a wildlife habitat acquisition program. Both wetlands and uplands are acquired but most emphasis has been on uplands since the state relies on the United States Fish and Wildlife Service to preserve wetlands. However, 60,000 acres, about 35 percent of all acquisitions, are wetlands.

Presently, state statutes prohibit acquisition of wetlands for wildlife habitat by any means other than purchase.[24] Uplands may be either purchased or leased for six years, but permanent easements are not allowed. Acquisition in recent years is negligible because the $300,000 appropriated for that purpose is expended meeting the legal requirement of paying school and county taxes so local governments do not have to bear the tax exempt burden of state-owned property.

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[24] Historical rationale is not known but current state officials feel that purchase minimizes resentment. Persons who sell property realize they no longer have any interest in it whereas persons who grant an easement may at times feel they have some control over the land even though legally they have no such right.

There are no written guidelines to follow in identifying wildlife habitat for acquisition. Areas for acquisition are recommended by area managers. These recommendations are reviewed at several levels within the Game, Fish, and Parks Section and if found acceptable, an offer is extended to the landowner. One criteria applied when reviewing a recommendation is whether the area of the state has sufficient amounts of public land to meet public recreation opportunities.

North Dakota

Drainage Law

North Dakota's drainage statute is intended to resolve conflicts among neighboring landowners rather than to preserve wetlands. Private drainage requires a permit when water is drained from a pond, slough, or lake which drains an area comprising 80 acres or more. All applications are reviewed by the local water resource district and by the State Engineer if the drain will have statewide or interdistrict significance.

Primary criteria for granting a drainage permit is whether the drain will flood or adversely affect downstream lands. If investigation shows that downstream lands will be adversely affected, no permit will be granted unless flowage easements are obtained. Agencies reviewing drainage applications are also to consider the well-being of all people of the state; storage of maximum water supply; and management, wise utilization, and protection of water and related land resources (North Dakota Century Code 61-01-26). Likewise, water resource boards have the responsibility and mandatory duty to encourage all landowners to retain water on the land to the maximum extent possible in accordance with sound water management policy. Criteria for review of drainage permit applications will now be (in addition to whether lower lands are adversely affected) whether sound water management requires the water not be drained. Whether this relatively new statutory language will alter water resource board considerations when reviewing drainage applications is still to be seen.

The State Engineer has defined statewide significance to include those cases where drainage would affect recognized fish and wildlife areas. But the major criteria for granting a permit is still whether downstream lands will be adversely affected.

If the drained watershed is less than 80 acres, no permit is required. The standard as established by case law, is reasonable use; that is, a landowner may drain his land in good faith and cast a burden upon land of another if (1) there is a reasonable necessity, (2) reasonable care be taken to avoid unnecessary injury, (3) benefit accruing to drained land reasonably outweighs harm to burdened land, and (4) it is accomplished by improving a natural drain or reasonable and feasible artificial drain. Again the intent is to resolve questions among landowners; not preserve wetlands.

Drainage permits have been required since 1957 but it was not until 1975 that the State Engineer was granted increased authority. Since that time the number of applications for drainage permits has been decreasing (Table 41). According to the State Water Commission, the required public hearing is one reason for the decrease in applications and increase in illegal drains. Total drainage is believed to have lowered in the past two to three years due to economic conditions. The economic situation in agriculture may be the major reason for the decline.

TABLE 41. NUMBER OF APPLICATIONS FOR DRAINAGE PERMITS IN NORTH DAKOTA, 1976-1980

Year	Number of Applications
1976	over 700
1977	232
1978	166
1979	89
1980	87

SOURCE: North Dakota State Water Commission, personal communication, June 1982.

State statutes provide for investigation and closure of any unauthorized drain. Closure of an unauthorized drain could restore a wetland. However, complaints of illegal drainage must be in writing which discourages reports of violations. One example of the State Water Commission enforcing the law involves a series of drains in Bottineau County, North Dakota. In about 1976 a group of landowners petitioned the local drain board to authorize and construct a drainage ditch. As a result of the board's inaction, the landowners jointly had the drain constructed. The area of the watershed was well over 40 acres (state law at the time required a permit to drain an area over 40 acres; this was changed to 80 acres in 1977) but no permit had been obtained. One of the lower landowners to be adversely affected by the drain was the J. Clark Salyer Wildlife Refuge maintained by U.S. Fish and Wildlife Service. The Service documented drainage activity on 542 quarter sections and the quantity and quality of the resulting drained water. This information was given to the State Water Commission. The Commission brought suit. The Court found the drain to be illegal and ordered it closed. However, the Court stayed the closure order on the condition the landowners made progress in establishing a legal drain. After some delay, the local drain board established a drainage district.

The next-step was to secure a drainage permit from the Commission. A conditional permit was granted in 1981. The conditions required that the existing drain be modified to reduce erosion and other adverse impacts on lower lands. A change in slope, installation of control devices, and, in some places, even a change in the route were required. In the fall of 1982 the last parts of the modified ditch should be operational (Beckstrand, personal communication).

Following the granting of the permit, North Dakota Chapter of Wildlife Society filed suit in state District Court seeking (1) declaratory judgements that the permit and continued operation of the drain are illegal, (2) an injunction against continued operation of the drain, and (3) an order to restore the land (close the drain) and revoke the permit. Theories of the case are (1) permit granting procedure as set forth by state statute was not adhered to, and (2) adverse impacts to lower lands are such that permit could not be granted unless flowage easements had been acquired, which had not occurred in this case. Litigation is presently in pre-trial stages with no trial date set (Eisberg, personal communication).

The other aspect of the drainage controversy near the J. Clark Salyer National Wildlife Refuge concerns hundreds of small private drainage projects. The USFWS documented drainage in a five county area occurring on 542 quarter sections in 1976, 144 quarter sections in 1978, 86 in 1979, and 17 in 1980 (personal communication, Kevin Brandan). Photography documenting the 1976 drainage and landowner names were forwarded to the North Dakota State Water Commission. The Commission did inform the local drainage board(s) and sent 200-300 violation letters to landowners in Bottineau County (Malcolm, 1978). State law, however, assigns the authority to force closure of illegal drains to the local boards, not the State Water Commission (NDCC 61-16.1-52). No drains have been closed to date (August 13, 1982) according to Brandan.

USFWS at J. Clark Salyer are involved with a number of other public drains in the area, including the Boundary Creek Project, Brandan Drain, White Spur Project, and at Hurricane Lake near Devils Lake, North Dakota. The Boundary Creek Project, a Soil Conservation Service PL566 project completed in 1981, has caused siltation problems in the Refuge (Brandan, personal communication). It has also affected a Waterfowl Production Area by lowering the water level and stimulated drainage of some Type 3 wetlands.

Comments by North Dakota officials were that the drainage law had little effect on drainage and that few bother to file for permits. Federal officials suggested, though, that state laws could help preserve wetlands if it was possible to overcome local political pressure. They added that local sentiment prevented the state laws from having any major affect.

Game and Fish Department

North Dakota Game and Fish Department manages the state habitat acquisition program. Priority is placed on uplands and woodlands since the U.S. Fish and Wildlife Service is charged with preserving wetlands. However, this does not prohibit North Dakota Game and Fish from acquiring wetlands when there is a willing seller.

Funds for acquisition are both appropriated by the state and received from the federal government. Due to the Garrison controversy, federal funding has been terminated. This reduction in resources, as well as the state law requiring all Game and Fish acquisitions to count as mitigation acres has stopped all purchases since 1979.

Another program was established in 1981 allowing leasing of uplands and small acreages (less than 20 acres) with wetlands (must be less than 7 acres). Mitigation law does not apply to these leases.

Land acquisitions total 69,600 acres owned and another 76,000 acres managed. An estimated 26 percent of these are water bodies--mostly wetlands.

Summary of Government Programs

Numerous federal and state programs and policies affect prairie potholes. Some overlap, that is, they protect the same wetlands, others leave particular wetlands without any protection, still other programs have conflicting objectives and effects.

The extent of the overlap between water bank programs and U.S. Fish and Wildlife Service easements is well-known. However, USDA adjusts the payment rate when the water bank wetland is also under easement. USDA also points out that the two programs are not identical because water bank includes upland adjacent to wetlands, something that U.S. Fish and Wildlife Service easements do not do. Likewise, the programs impose different limitations on landowners. Finally, greater economic incentives to preserve wetlands by participating in both programs may be protecting some wetlands that would otherwise be drained if dual participation was prohibited.

Minnesota is the only state in this study with an operating state water bank program and its statutes implicitly prohibit simultaneous enrollment of a wetland in federal and state water bank programs.

Another overlap is Minnesota property tax exemption/credit program with Water Bank and easement programs. However, Water Bank and U.S. Fish and Wildlife Service easement apply only to wetland types 3, 4, and 5 whereas the property tax program applies to all wetlands.

Some programs (especially the volunteer programs) may protect wetlands that would not have been drained anyway. The hypothesis is that if the land is worth draining within the next few years, the owner will not participate. Instead, landowners who do not intend to drain are most likely to participate.

Some of this problem is eliminated by adding the criteria that drainage by legal, feasible, and practical in order to qualify. Landowners in voluntary programs can cease participation whenever it is to their advantage to do so and usually without undue penalty.

One of the major programs conflicting with preservation of wetlands was eliminated by cessation of drainage cost sharing USDA-ASCS. It will be difficult to stop provision of technical information about drainage. It is not clear whether income tax policies actually stimulate drainage but a change in law would be necessary to end any chance of encouraging drainage.

There are gaps among the programs. Section 404 regulates fill and discharge activities in all wetlands. By removing dredged material to upland, drainage of any wetland is beyond jurisdiction of 404. Minnesota's statute regulating drainage applies only to type 3, 4, and 5 wetlands leaving all other types without protection. Also, the 10 acre lower bound in both 404 and Minnesota Protected Waters leaves many type 3, 4, and 5 wetlands unprotected.

North Dakota and South Dakota drainage regulation is intended to resolve conflicts among neighbors and not to preserve wetlands. Water Bank programs emphasize types 3, 4, and 5. This leaves other wetland types free to be drained.

Wetlands protected by short-term programs (such as Minnesota's property tax program) are vulnerable to changes in the economy. Fluctuations in program funding levels also impact wetlands preservation. Decreased participation in USDA Water Bank is due to reduced levels of funding as annual appropriations are nearly always exhausted and applications by potential participants are not being funded.

Finally, interviewed persons agree that economic incentives will probably perform better than regulation. However, some of the respondents felt a program which combines both would be the most effective.

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Appendix B--Comments of Respondents

Comments About Reasons for Drainage

ND Soil Conservation Service:

The following items are ranked in order of importance:

1) Price of wheat.
2) Short-term climatic factors.
3) Poor livestock prices led to transforming rangeland to cropland.
4) Property tax system.
5) Road building has both a direct effect and provides public drainage.

ND Agriculture Stabilization and Conservation Service:

1) Larger equipment increases the drainage incentive and provides the means.
2) Economics and increase in cultivated land.
3) Technological changes has been hard on Types 1 and 2 particularly.
4) Long-run climatic changes are insignificant.

USFWS, Minnesota:

1) Economic situation is the major factor, particularly on Types 1, 2, and 3.
2) Irrigation.
3) Larger equipment.
4) Some younger farmers recognize the importance of wetlands.
5) Larger farmers do most of drainage.
6) Many younger farmers have cash flow problems which increases the financial pressure to drain wetlands.
7) Climate.
8) Highway ditches.
9) IRS tax deduction for drainage.

Minnesota Department of Natural Resources:

1) Economic situation most important.
2) Climatic, long-run (decade), cycle.
3) Change from mixed to specialized row crop farming.
4) New type of farmer--the agribusinessman.
5) Technology change.
6) Social attitudes.
7) Increasing farm size.
8) "Good" farming practices--clean, black, and straight fields.

South Dakota Attorney General:

1) Irrigation.
2) Economic situation.
3) large equipment to enable farmer to drain his own wetlands.
4) Recent wetlands.
5) If one drains, frequently his neighbors will follow.
6) Climate is insignificant.

Comments About Reasons for Drainage (Continued)

USFWS--South Dakota	1) Large farm equipment-four wheel drive tractors. 2) Road building-direct and indirect (drainage ditches) effects. 3) Center pivot irrigation. 4) Land values. 5) Farm commodity prices. 6) Change in ownership-new owner is more likely to drain.
ND State Water Commission:	Climatic cycle (long-term) is most important.
MN Water Planning Board:	1) Economic situation is the major determinant.
ND Game and Fish:	1) Drainage rate jumps every time a large public drain opens. 2) Commodity prices. 3) Dry years facilitate drainage. 4) USDA cost-share promoted drainage. 5) Technology change-farmers own their drainage equipment. 6) High land prices. 7) Governmental attitude toward drainage has been favorable, may be changing. 8) Uncertainty about the value of wetlands and certainty of the opportunity costs, i.e., crop production.
U.S. Corps of Engineers, St. Paul:	Economic pressures, particularly on marginal wetlands, Types 1, 2, and 3.
USFWS, North Dakota:	1) Rangeland conversion to cropland and resulting removal of wetlands. 2) Soil erosion is filling many wetlands without explicit drainage and fill activity. 3) Precipitation trends have no effect. 4) Changed attitudes with new generation of farmers, i.e., agribusinessmen. 5) Large equipment. 6) Generally improved understanding exists as to the value of wetlands, however economic pressures remain. 7) Everything is drainable with modern equipment.
USFWS, Fergus Falls, Minnesota:	1) "Convenience" drainage to eliminate obstacles. 2) Federal and state income tax deductions for drainage costs. 3) Investment tax credit granted for tile drainage. 4) Increased tractor horsepower has facilitated farmer performed drainage and less contractor drainage. 5) New flexible PCV pipe is being used to deepen prior surface drains. 6) Decrease in livestock and forage production. 7) Decrease in small and medium size family farms.

Comments About 404

North Dakota Water Commission: It has done very little in North Dakota

South Dakota Game, Fish, and Parks:

1) Does OK
2) Do not want 404 to revert to state and local control because it would be more susceptible to local political pressure.
3) Enforcing 404 could be a problem. Must rely on other agencies to report violations. Game, Fish, and Parks report 1 or 2 a year to Corps but these more often involve rivers rather than wetlands.

South Dakota Attorney General: Assistant Attorney General, Game, Fish, and Parks

1) Lack of enforcement, only one violation has been forced to restoration and after-the-fact permits are too easily acquired.
2) Violations are reported by affected neighbors, concerned citizens, State Conservation, Conservancy districts.
3) Environmentalists do not monitor and are not the reporters of violations. They usually get involved after violations have been reported.
4) Rates 404 as poor due to its lack of enforcement. It may help to add drainage language. Landowners do not realize that drainage is not within the scope of 404.
5) Lack clear understanding as to who has jurisdiction. State expects Federal government to regulate under 404. Federal agencies expect states to enforce. Inclination to have federal government take responsibility, however, they lack enforcement capability.
6) If jurisdiction was clearly delineated, the responsible agency would be unable and less inclined to "pass the buck." Helpful to clear up who is responsible.

Minnesota Department of Natural Resources:

1) Include drainage in 404 program.
2) Insignificant factor in influencing changes in wetlands.
3) Permit process is ineffective in reducing unnecessary changes to wetlands because applicant applies for permission to do more work than he really needs or wants but then has room to negotiate by offering to reduce scope of application in return for a permit.

Corp of Engineers, St. Paul:

1) Problems with 404:
   a) was never intended to reach wetlands
   b) Does not address drainage; only fill and discharge

Comments About 404 (Continued)

Corp of Engineers, St. Paul
(Continued):

   c) Corps should have authority to administer swifter penalties, penalties not only for violating a permit but also for violating Clean Water Act.
   d) Nationwide permit should be written in terms of activity rather than type of wetland
   e) Proposed regulations expand a nationwide permit to encompass even more wetlands and authority to remove wetland from scope of nationwide permit moves to a higher and more distant level within the Corps.
   f) No clear definition of when material is waste and within 402 jurisdiction and when it is fill and within 404.
   g) Redefine dredging to include drainage or dredging.
   h) No easy way to enforce the prohibition against activities which convert wetlands to agricultural use.

2) Field employees of other Federal agencies could be required to report 404 violations.
3) Wetland owners do not know about 404 nor how to avoid its jurisdiction.
4) Key to the problem is voluntary compliance; authority for swifter penalties and strict enforcement to demonstrate the Corps policy will increase voluntary compliance. Voluntary restoration works fairly well.
5) Corps' experience has been a high degree of compliance; also has attained numerous restorations of wetlands, some were voluntary restoration.
6) The way the law is written now, even money and personnel will not stop drainage; need to change the law instead. Concise law and regulation with "teeth" can handle preservation of wetlands even without increse funding or staff. Primary change should be to include drainage activities as well as fill and discharge.

United States Fish and
Wildlife Service,
St. Paul:

1) Rewrite nationwide permit to categorize according to activity rather than type of waterbody.
2) Problem lies with the regulation itself. Should be changed so that 404(b)(1) criteria is applied as threshold test to determine whether a permit should be issued. If yes, then apply the public interest test. Presently, 404(b)(1) is just one subpart of the public interest test.
3) EPA could include prairie potholes in 404 by using 404 (c), but politics prevents it.

Comments About 404 (Continued)

United States Fish and Wildlife Service, St. Paul (continued):

4) Complicated regulation, so subjective, difficult to administer.
5) Discretionary authority is seldom used, never requested by Fish and Wildlife. Requests usually originate with others and Fish and Wildlife becomes involved during processing of application. Exercise of discretionary authority delays processing of applications.
6) Nationwide and general permits remove all but a very small portion of wetlands from individual permit requirements. (8 percent of wetlands still need individual permits according to one study.)

United States Fish and Wildlife Service, Bismarck:

1) Affects public and large projects but ignored by most.
2) Many are not aware of 404.
3) Enforcement is voluntary.
4) Proposed regulations are a negative step.
5) Nationwide permit for waters less than 10 acres misses most prairie potholes.
6) Problems in that 404 applies only to fill.
7) Corps lacks personnel in the field to identify violations.

Minnesota Water Planning Board:

404 is useful backup for state programs with the states passing to the Corps the more difficult questions.

North Dakota Game and Fish:

1) Lacks effective monitoring.
2) Has stopped drainage at times but this leaves it with bad public relations.
3) Responses to criticism by passing it to game and fish.
4) 404 permit process too long.

USFWS--Midcontinent Waterfowl (Research Unit):

1) Not effective against private drainage of potholes.
2) Add drainage to jurisdiction of 404 but this still would not solve problem for types 1 and 2.
3) Both types 1 and 2 and those less than 10 acres are important. In fact, if all 1 and 2 and less than 10 acres were drained, half of waterfowl could be lost.
4) High percent of 3, 4, and 5 and over 10 acres would not be drained even if there were no law.
5) There is not protection for 3, 4, and 5 less than 10 acres.
6) 404 is regulatory not preservation.
7) By including drain activities, and less than 10 acres, 404 could be more effective; would certainly help state programs.
8) Enforcement would not be definite.

Comments About 404 (Continued)

North Dakota SCS:	1) No effect 2) Regulates only fill; still legal to drain 3) Enforcement problem
United States Fish and Wildlife, South Dakota:	1) 404 has not hurt wetlands, but has it prevented drainage? We do not really know. 2) Use of 404 is increasing 3) Would like to keep 404 4) Little publicity 5) Few permits denied, few permits withdrawn; otherwise approved.

Comments on Wildlife Acquisition Programs

Program	Commentator	
USFWS	ND ASCS	1) Significant factor but acquired wetlands probably would not have been drained anyway. 2) Concentrated acquisition in too limited areas. 3) Acquisitions should be less concentrated and more evenly distributed over larger areas.
USFWS	Water Planning Bd	Permanent easements are better than annual leases.
USFWS	ND Game & Fish	1) Effective
Game & Fish	ND Game & Fish	1) Acquires upland and forest lands, now acquiring some wetlands along lake Sakakawea
Easements	USFWS (Midcont.)	1) Easements have been a success--North Dakota even more than Minnesota. Why?--different land values, different topography, different crops, difference is aggressiveness of USFWS personnel, difference in extent drainage is already established.
Acquisitions	ND SCS	2) About $10 million of value to state as result of preserving wetlands 3) Easement and fees are effective but tough to enforce due to political pressure.
USFWS	USFWS (Brookings)	Easements and fees are effective
USFWS	Minn. DNR	1) Easements and purchases are important
	Minn. DNR	2) Minnesota purchases are important but easements are insignificant factor in wetlands
USFWS	Corps (St. Paul)	Effectiveness varies according to area, land prices and appropriateness
Acquisition	USFWS (St. Paul)	Fund acquisition program so landowner has economic alternative

Comments on Wildlife Acquisition Programs (Continued)

Program	Commentator	
Acquistion	SD G, F, & P	Perfer permanent easement to lease; lease is just too short
Acquisition	SD Att. Gen.	1) Prefer purchase over easement but both are good. 2) Easements cause resentment because landowner still feels they are entitled to more control. Purchases, on the other hand, do not allow such a feeling. The sellers know they no longer have any right to the property.
USFWS Easements	SD Game & Fish & Parks	Definite effect in SD, prevents later owners from draining which causes later owners to complain.
Acquisitions	USFWS (St. Paul)	DNR + USFWS acquisition coordinate well.

Comments on WaterBank

Program	Commentator	
Fed	ND State ASCS	Definitely positive influence, objective is to help wildlife
ND	USFWS Bismarck	1) No funding
Fed	USFWS Bismarck	2) 60,000 total acres of which 25 percent are wet
Any	Water Planning Bd MN	Continue water bank but should also have permanent acquisition, trade-off between permanent leases and annual leases.
Fed	ND Game & Fish	Effective
ND	ND Game & Fish	Not effective, lacks funding
Fed	USFWS Brookings	Effective
	Minn. DNR	1) Overlap between federal and Minnesota program. So far all state water bank applications have been funded. 2) Overlap is stopped, if at all, at local county level. 3) Minnesota water bank and Minnesota tax credit program also overlap. 4) Water bank program eliminates "taking" question. 5) Lack of alternative cash flow encourages use of water bank 6) Water Bank programs are bad precedent. Should instead regulate rural land including drainage of wetlands under the same social and legal principals used when regulating urban areas, for example, with zoning.

Comments on WaterBank

Program	Commentator	
	Minn. Dept. of Revenue	Overlap between Minnesota and Federal Water Bank programs and Minnesota tax credit program.
	Corps (St. Paul)	1) Effectiveness varies according to area and price of land in that area; also appropriations. 2) Water bank recognizes the lack of alternative economic uses for wetlands

Comments on Wildlife Acquisition Programs

Program	Commentator	
Any	USFWS (St. Paul)	1) Participation is good because landowners are cashing in.
Fed	USFWS (St. Paul)	2) Water bank is running out of money. 1972 contracts are now expiring. 3) Was good program but is now in bad shape. 4) USFWS is trying to acquire fee title to best wetlands as their water bank contract expires.
Fed	SD ASCS	Good program, especially because it protects wetlands by presenting a buffer zone--that adjacent acreage.
Any	SD Att. Gen.	Good concept but not being used much
	SD Game, Fish & Parks	1) Good program but participants would not have drained anyway 2) Does not prevent later drainage

Comments About Tax Programs

Program	Commentator	
MN Tax Prog.	USFWS Bismarck	1) Effective program
MN Tax Program	Water Planning Bd	2) Federal tax credit could also be effective, more effective than water bank, generally favored the program
Exemption	ND Game & Fish	1) Marginal at best 2) Compare the affects of a tax exemption program to a tax credit program.
Deduction for drainage expense	USFWS (Midcont.)	1) Eliminate deduction for drainage costs, including depreciation of tile and investment credit on tile. 2) Replace with income tax incentive to preserve wetland. 3) ASCS could help enforce such a tax program.

Comments About Tax Programs (Continued)

Program	Commentator	
Tax Credit	ND SCS	1) Tax program is a factor in whether drainage will take place. 2) Federal income tax credit would be a fair program. It would be annual, would place public value on the property; but would be vulnerable to other economic factors. 3) State tax exemption or credit program is good but expensive for states.
Tax Credit	Minn DNR	1) Property tax exemption and credit program varies from county to county 2) Insignificant in affecting wetlands. 3) Should have dollar limit on amount of credit per acre.
Tax Credit	Minn Dept. of Revenue	1) Overlaps with water bank and USFWS easements. 2) Future may bring elimination of exemption part. 3) Wasteland receiving wetland credit 4) Need tighter definitions
Tax Credit	USFWS (St. Paul)	No feel for effect of tax credit program. Do not know if it prevented drainage.
Deduction for expenses	USFWS (St. Paul)	Reduces cost of drainage
Deduction for expenses	Att. Gen.--SD	Reduces cost of drainage

Comments on State Drainage Laws and Inventory Programs

Program	Commentator	
SD Drainage Law	SD Att. Gen.	Has not hindered nor encouraged; it just does not control it.
ND Drain Law	USFWS Bismarck	Has little effect on rate of drainage
MN Drainage	Water Planning Bd	Intended to provide technical, engineering service to local governments
MN Protected Waters	Water Planning Bd	1) Should be effective program when completed 2) Will work ok for protected waters but does nothing for the rest. 3) Much is not within protected waters due to political pressure brought by landowners 4) Fewer drainage permit applications lately but that is due to economics 5) Drainage is moving to new areas 6) Some old drains are being repaired and also dug deeper; does that make it a new drain?
ND Drain Law	ND Game & Fish	Few bother to file for permit

Comments on State Drainage Laws and Inventory Programs (Continued)

Program	Commentator	
MN Protected Waters	USFWS (Midcont.)	1) Minnesota protected waters is fine for the protected waters but does nothing for the rest. The rest is a large proportion and necessary. 2) Protected waters would not be drained anyway.
State Laws	ND SCS	State laws have little affect, too much political pressure.
MN Protected Waters	Minn DNR	Would be good to include types 1 and 2 wetlands but political pressure will not permit it. When Minnesota inventory is complete, it will be excellent for types 3, 4, and 5.

Comments on State Drainage Laws and Inventory Programs

Program	Commentator	
MN Protected Waters	Corps (St. Paul)	Minnesota regulates the easy wetlands and leaves the difficult ones to the Corps. Gap between DNR program and 404 program.
State Laws	ND ASCS	State laws help preserve wetlands.

Comments on SCS and ASCS Drainage Assistance As Well As Impact of Executive Order 11990

Commentator	
State Game, Fish, and Park	Change in SCS and ASCS programs had little affect on drainage; if landowner wants to drain, he will. SCS and ASCS are not discouraging drainage, either.
SD Attorney General	Executive Order 11990 had no affect
ND ASCS	No large effect as SCS and ASCS discontinued assisting drainage
USFWS Bismarck	ASCS subsidized drainage; it was a factor
ND Game & Fish	USDA programs stimulate drainage. State attitude supports drainage. Government support for drainage.
USFWS (Midcont.)	Executive Order 11990 applied only to federal projects and agencies.
Minnesota DNR	SCS is no longer allowed to provide technical information about drainage. This implies SCS assistance encouraged drainage at least to some extent in the past.
USFWS (St. Paul)	Reduction in level of SCS assistance to landowners desiring to drain had had an impact on drainage of wetlands.

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